WALKING TOUR
CARPINTERIA OIL SEEPS
SANTA BARBARA COUNTY, CALIFORNIA

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Note: In this report, italics within the text of this report indicate quotations.

ABSTRACT

The Carpinteria Oil Seeps are among the largest and most easily accessed oil seeps along the California central coast. They were used by the Chumash in prehistoric and historic time. During the Spanish era, the seeps were developed as a source of kerosene. Open pit mining of the oil seeps began 1857 and continued intermittently through 1927. Presently the seeps are within Carpinteria State Park. The seeps extend along the waterfront from the middle of the State Campground in the northwest the Chevron offshore service pier in the southeast. Remnants of asphalt mining are exposed at low tide. These including railroad tracks, retaining walls and ovens. Most of the seeps are within the Miocene Monterey Formation and are associated with bedding planes and fractures. Some leak upwards into overlying Pleistocene "Punta Gorda" marine terrace materials. The geological and historical features of these seeps are best viewed during the winter at low tide when beach sand and gravel accumulations are minimized. The walking tour also describes beach erosion and attempts to arrest it.

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INTRODUCTION

Oil seeps fascinate. They are unusual features and only occur in a few dozen places on earth. California is home to several of them. In the 1846 when it was discovered that petroleum could be made into kerosene, it became an economic engine for industrialization. The Carpinteria oil seeps are part of this history and many artifacts remain for casual viewing. This walking tour is as much a walk through time as it is through rocks and their associated features. One purpose of this hiking tour is to learn about the stratigraphy, faulting, folding, diagenesis, hydrocarbon generation/migration and other geologic parameters of the seeps. Another goal is to appreciate the long history of human interaction with them.

LOCATION

The Carpinteria oil seeps are within the city limits of the town of Carpinteria, California. All of the seeps are along the coast on the old El Rincon-Arellanes Land Grant in Carpinteria State Park. They are in projected portions of T.4N, R.25W, Section 33 and 34, SBM. The California Division of Oil and Gas and Geothermal Resources (CDOGGR) compiled location data on oil seeps of California in Technical Report 26 (Hodgson, 1980)

CA Seep Number	LONGITUDE WEST	LATITUDE NORTH	Township	Range	Section	Base Meridian
2-61	-119.5120	34.3880	4N	25W	33	SB
2-62	-119.5080	34.3860	4N	25W	33	SB
2-63	-119.5070	34.3860	4N	25W	33	SB
2-64	-119.5040	34.3850	4N	25W	33	SB
2-88	-119.4990	34.3850	4N	25W	33	SB
2-89	-119.4950	34.3850	4N	25W	34	SB

TABLE 1. LIST OF OIL SEEPS AT CARPENTERIA STATE BEACH. From CDOGGR website. Data from Hodgson (1980).

HISTORICAL OVERVIEW

Six million years ago, when the present Central Coast of California was where Ensenada, Mexico is now, there was a broad, shallow sea. It was the Late Miocene period and up-welling currents provided nutrients for ocean-going microscopic plants (diatoms), bacteria, archaea and protozoa (Ingle, 1981, 1983). They lived and died, or were consumed by larger marine animals. Settling to the bottom of the sea, those diatoms and other plankton were buried to depths of several miles. The heat, pressure and waters trapped in those buried sediments converted the organic matter to kerogen. The kerogen migrated out of the shales. With more pressure and over more geological time, kerogen would heat to its “oil window” (60-160 degrees Celius) or “gas window” (120-125 degrees Celsius) and become either oil or gas. The hydrocarbons rose through the sediments along permeable bedding plains or strata (sand) or along faults and fractures. Sometimes they came all the way to the surface and became oil and gas seeps.

Prehistoric peoples used the asphalt (tar) from the oil seeps in a variety of ways. It waterproofed wooden-plank canoes (tomoles) which were rowed to and from the Channel Islands. It attached arrowheads and feathers to arrow shafts. It was used to glue and waterproof open-ended baskets to round stones. This made a hybrid cooking pot that could resist damage from hot stones placed therein. It waterproofed the interior of water bottles and used for shell-bead inlay on vessel rims (Arnold, 1993; Abbott, 1879: Franks and Lambert, 1985, Grant, 1962, Rintoul, 1990, p. 1-3).

Yerkes, Wagner and Yenne (1969) gave this summary of pre-European asphalt use at Carpinteria:

The asphalt deposit at Carpinteria was located near the sea cliff, about half a mile southeast of town. The archeologic record reveals that aborigines used asphalt for holding points on weapons (Abbott, 1879); and Spanish explorers, dating back to at least 1775, observed that Indians near the present site of Carpinteria used tar from those deposits to calk their boats and to seal their water pitchers (Heizer, 1943). As early as 1857 the Carpinteria deposit supplied material from which illuminating oil was distilled; the quarry pits were as deep as 25 feet and covered several acres (Eldridge, 1901; Yerkes and others, 1969, p. 13-14).

During the Spanish Era, and before the discovery of kerosene in 1841 (Beaton, 1955), oil from seeps was a lubricant and under some conditions used as a crude fuel. As early as 1857 the Carpinteria asphalt deposits supplied material from which illuminating oil was distilled. At that time, the quarry pits were as deep as 25 feet and covered several acres (Eldridge, 1901; Yerkes and others, 1969, p. 13-14; Franks and Lambert, 1985).

These seeps and others in California were extensively studied by U. S. military surveys in the decade following the Gold Rush and described in the Pacific Railroad Reports, published prior to the Civil War. The primary purpose of these surveys was to find the best routes and locate potential fuel sources The discovery of gold gave great impetus to mining endeavors throughout the country, and this increased activity, combined with the prosperity after the Mexican War, interested several States in the South and the Midwest in establishing State geological surveys. It also made the development of better means of communication and transportation between the Eastern States and the western territories more urgent. In 1853, Congress appropriated $150,000 for surveys to ascertain the most practical and economical route for a railroad from the Mississippi River to the Pacific Ocean and authorized the Secretary of War to employ the Corps of Topographical Engineers to make the explorations and surveys. The Congress also took action on the mineral lands in California, excluding them from the General Land Office surveys, settlement or location on them (U.S. Geological Survey, 2023).

During the 1850's, while the Topographical Engineers explored four routes for the transcontinental railroad, the industrialization of the Nation quickened. In 1859, for the first time, the value of the products of U.S. industry exceeded the value of agricultural products. In that same year, gold was discovered in Colorado, silver was discovered at the Comstock lode in western Nevada to begin the era of silver mining in the West, and the first oil well in the United States was successfully drilled in northwestern Pennsylvania. By that time, the relationship between geological surveys and mineral resources was sufficiently clear that when gold mining in California became difficult and costly, the State Legislature established a Geological Survey, on April 21, 1860, to make an accurate and complete geological survey of the State. (Sorenson, 2022).

Following Statehood (1850) and the Civil War (1866), oil pioneers came to the central coast and began “wildcatting”. Many of these early wells were at or near seeps (Rintoul, 1990).

Josiah Dwight Whitney was the first California’s State Geologist and director of the California State Geological Survey from 1860 to 1874. He described the Carpinteria seeps as “black and highly bituminous [shales of the phosphatic member of the Monterey Formation with asphalt that] saturates the beach sand and flows down to the sea (Caldwell, 1979).

Henry Hanks (1884) described “Carpinteria asphalt deposits”:

Situated three miles southeast of the town, though not spread over so large an area as some others, shows the heaviest surface accumula-tion of any deposit in the State. This bed, already large, is constantly being added to, the more volatile portions of the maltha and petroleum, which issue from innumerable fissures in the mass, escap-ing and leaving the heavier behind. This residuum hardens gradually, at first to the consistence of tar or putty, becoming finally so solid that picks and crowbars are required £or breaking it out. The softer portions of this material, flowing off and gathering up the sand and gravel with which they come in contact, have been con- verted into a vast bed of concrete, some parts of which extend far· out into the sea. The mineral oil at this locality exists under such varying conditions of fluidity and hardness, that it is possible to obtain here some pure petroleum, together with large quantities of asphaltum and maltha. Formerly a good deal of asphaltum was shipped from this deposit to San Francisco (Hanks, 1884, p. 287).

In 1890, Solfataras described “fire wells”and associated tunnels at the southeastern end of the Carpinteria oil seeps at Rincon Creek in the area of the now-abandoned Rincon Oil Field:

The second group of "fire wells" visited are about three-fourths of a mile below a point where the Rincon Creek [at the now-abandoned *enters the sea and near the carriage road and railway leading from Santa Barbara to Ventura. Before the grading of the railway was accomplished, the traveler by the beach road might have noticed some peculiar-looking rocks that had fallen from the cliffs above. The rocks appear to have been originally similar to those composing the mass of the exposed portion of the cliff, which arc principally light-colored shales, but their character, both in density, specific gravity, and color, has been altered by the action of mineral gases and great heat. Nearly all shades of red, yellow, and brown, and in some cases green, are colors represented. The intensity of the heat at some former period seems to have contracted the strata through semi fusion until it is excessively hard and gives a metallic ring when struck with a hammer* (Solfatraras, 1890, p. 13-14).

Reaching by an easy path a point about 300 feet above the base of the cliff, I was at once aware of the near existence of the "solfatara," or so-called "Rincon volcano," by the same exceedingly disagreeable odors that were noted in the Santa Ynez issue. Descending 20 or 30 feet, I found hot gases bursting from numerous apertures in the shales, accompanied in some cases by melted bitumen that hardened in concretionary masses upon cooling. The dip of the strata was at an angle of 50° toward the mountain. Crystals of sulphur had also formed upon all objects near the issue, and naphtha appeared to be present. A few years ago a tunnel was run into the cliff at its base to the depth of 200 feet in search of oil. At this depth the workmen were obliged to cease operations in their endeavor to penetrate farther on account of the great heat. Upon entering this tunnel I found the temperature still high, but noticed only weak sulphurous gases. Near the entrance for 50 or 60 feet the roof and sides were thickly covered with attenuated colorless crystals of epsoniite hanging in tufts and masses (Solfatraras, 1890, p. 13-14).

During the cooler months, as at the Santa Ynez locality, the gases arising from the principal orifices are seen from distant points, and the issue of so much smoke and accompanying heat has given rise to a popular idea that it is due to volcanic action. The local journals have from time to time given voice to this idea, and the frequency of earthquake shocks in the neighborhood has been attributed to the struggling efforts of the "Rincon volcano." When the excavations of the Southern Pacific Railway were made at a point a mile farther west from the locality just described, a similar issue was discovered, and upon touching a match to the gas combustion ensued and continued, notwithstanding vigorous efforts were made to extinguish it. The fumes caused much annoyance to the laborers, and not until masses of earth were dumped over the orifice did it cease to burn (Solfatraras, 1890, p. 13-14).

During the summer of 1888 Mr. Richardson, who resides a short distance below the Rincon "fire wells," was startled by loud reports in their direction, and upon visiting the locality observed flames issuing to the height of several feet from the apertures. Parties from Santa Barbara visited the spot upon hearing of this outburst and confirmed Mr. Richardson's observations. Apparently there have been periods of great activity, followed by long intervals of comparative rest. The partially fused rocks, with their altered color and density, would indicate a period of greater intensity of heat than at present prevails (Solfatraras, 1890, p. 13-14)

The geology and structure of the abandoned Rincon field is summarized in California Oil and Gas Fields, Volume II (CDC, 1992) and reproduced, below:

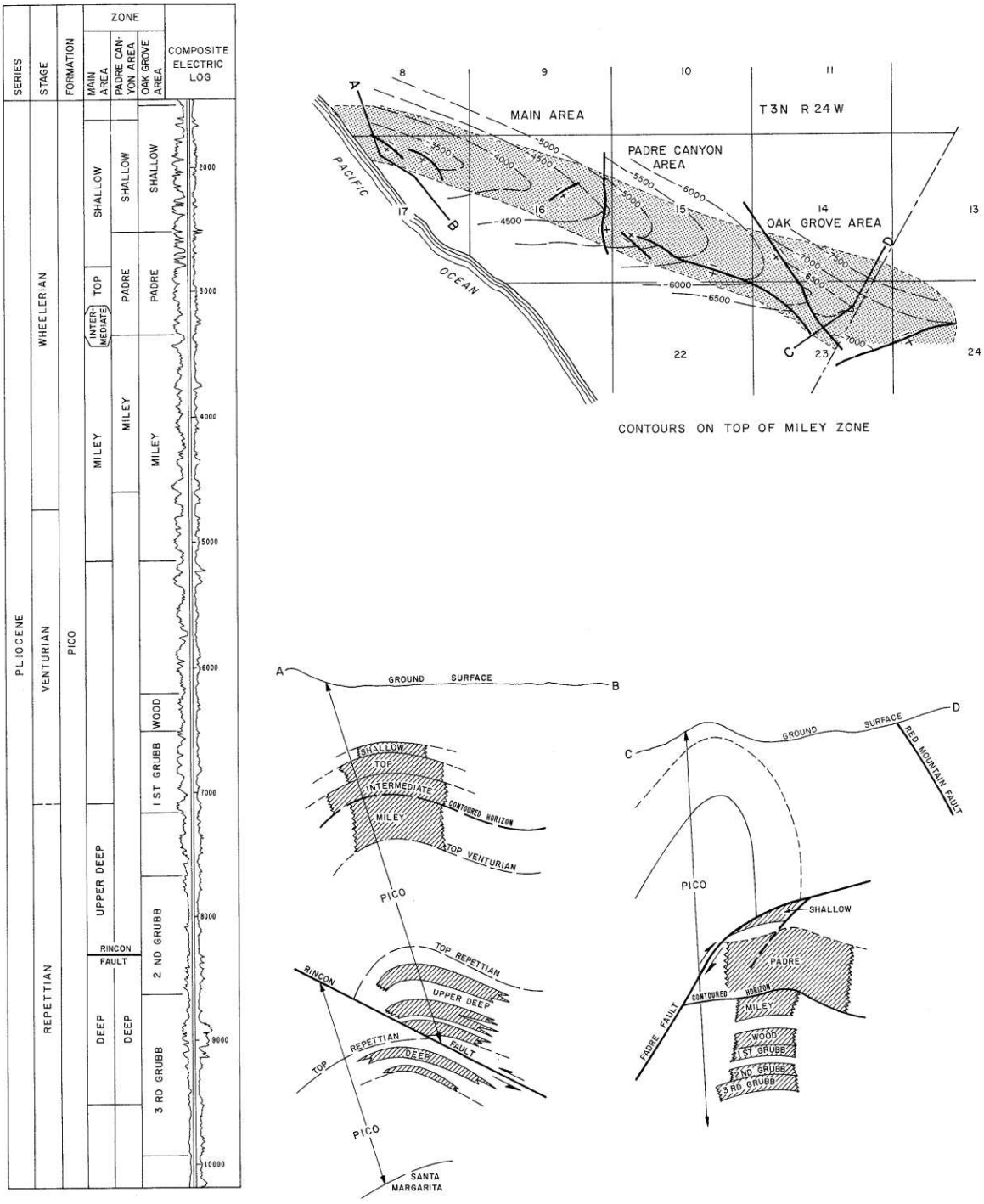

Figure 1. Geology and stratigraphy of the Rincon Oil Field. From California Division of Conservation, 1992, p. 419.

The Rincon field was discovered in 1927 produced from the Pliocene Pico formation at depths of 1,760 to 7,800 feet. These oil pools are related to the seeps by seepage along the Rincon and associated fault (Dibblee, 1987).

In 1907, Arnold said this about the Carpinteria asphalt deposits:

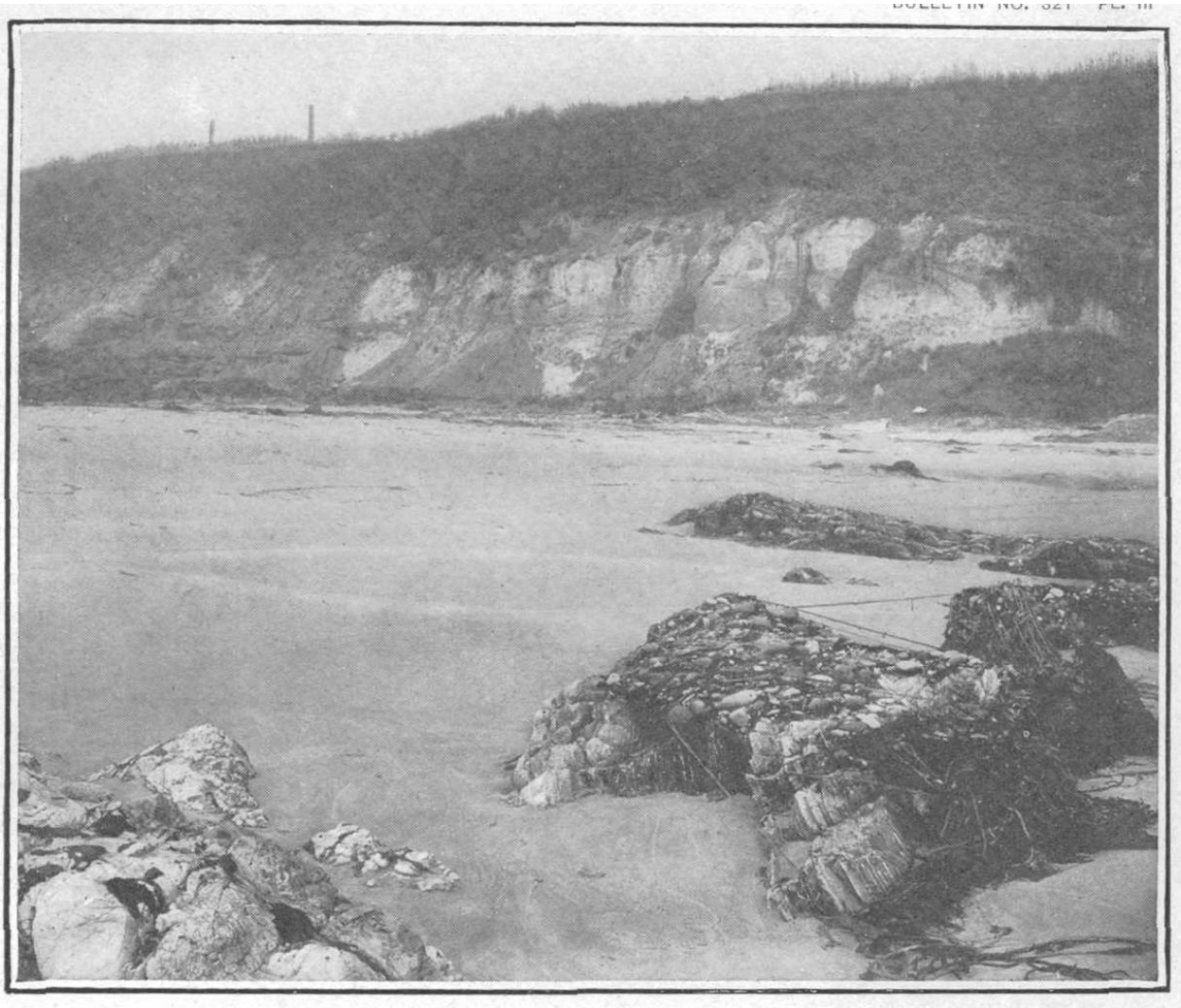

Figure 2. Beach near Carpinteria asphalt mine, showing upturned and contorted Monterey Shale. From Arnold, 2009, Plate III, Figure A, p. 29.

In the region of the Carpinteria asphalt quarry the shales are highly bituminous, and have assumed contrasting alternations of black, brown, and white, which are rendered more conspicuous by the action of the waves. Along the railroad immediately east of the area shown on the map the shale is interbedded at rare intervals by 4-inch to 24-inch, fine, brownish, more or less bituminous sandstone layers (Arnold. 1907, p. 28).

Figure 3. Tar volcano in Carpinteria asphalt mine. From Arnold, 1907, Plate III, Figure B, p. 29. From CalGEM collection

Asphalt Mining

Priestaf (1979, p. 168) described mining activities at the Carpinteria seeps:

Mining has extensively altered the Carpinteria deposits. In 1857, Charles Morrel, a San Francisco druggist, began a quarrying operation to provide material for distilling illuminants, but the mining venture did not prove to be very successful (Dibblee, 1966). Later quarrying operations, which lasted well into the 1920s, were far more successful. At one time more than 600 men were employed in the production of paving materials (Clark, 1962; Priestaf, 1979, p. 168).

The mining operations resulted in a series of pits lying just inland from the beach. These pits are approximately 25 feet deep and extend over several acres. Deposits of massive asphalt were largely removed in one of these pits. Miners left intact some of this asphalt which is now preserved as a "dike" or seawall between the beach and the low-lying pit. Timbers used to brace the sagging asphalt during mining operations are still visible, though now covered in part by the slumping, sagging asphalt they were meant to support (See figure 12 in Priestaf, 1979, p. 168). My figure 13 shows these remnant timbers in 2022).

Figure 4 (left). Remnants of retaining wall for shoreline asphault mining. October, 1977. Photo From Priesstaf, 1979, Figure 12.

The eastern quarry pits are still recognizable above the bluffs. Though most of the pit floors are now covered with iceplant, they are still obviously petroliferous. The bituminous sand is sticky and slightly yielding where softened in the sun, and thin pools of oil make walking hazardous. Seepage is still relatively active in the floor of the pits as indicated by miniature "tar volcanoes", similar but smaller than those described and photographed by Arnold in 1907 (See figure 13 in Priestaf, 1979, p. 168).

Edwards (1987, p. 76) expanded on Priestaf's summery of Carpinteria's asphalt mining history:

The first development was attempted in 1857 by Charles Morrell, a San Francisco druggist, who, with little success, attempted to produce illuminating oils from the asphalt (Priestaf, 1979) (Edwards, 1987, p. 76).

Figure 5. Asphalt mining at Alcatraz Mine, Carpinteria in 1905. From CDOGGR. A reversed image from the Carpinteria Valley Historical Society is in Edwards, 1987. Note railway. Compare with Figure 21, Stop W16, Figure 23. Provided by Bob Gray.

The first large-scale mining operation was undertaken, in 1875, by the Crushed Rock and Asphaltum Company of San Francisco which, by 1880, employed forty men. A succession of operators, notably Andrew Sattler, continued this effort throughout the late 1800's, at one time employing 200 men who were housed in barracks on the property, ate in the company dining room, and drank in the six saloons which had sprung up along Linden Avenue (Caldwell 1979). The miners worked in pits along the beach, using shovels heated in ovens to quarry blocks of bituminous sand which were loaded on rail cars and carried to a refinery near the mouth of Carpinteria Creek. The quarry pits were as much as 25 feet deep and covered several acres (Priestaf, 1979). At the refinery, the asphalt was heated in vats, washed with saltwater to remove the sand, loaded in barrels made on the property and shipped from a nearby wharf. Not all the uses to which this material was put are recorded, however, much of it was used to pave streets in Carpinteria and in Santa Barbara and to coat roofs. In 1887, a second asphalt mine, the Alcatraz, was opened on the bluffs to the east, near the present-day Chevron Oil Company property using the same mining methods as those used by Sattler. The first subsurface exploitation occurred in 1900 when a 350 foot "shaft" was sunk which filled with pure asphalt, selling in those days for thirty-six dollars a ton. Two years later this well was steamed through a two-inch line, allowing the asphalt to be recovered in liquid form. Operations such as these continued, off and on, until 1915, when both the Alcatraz mine and the Sattler operation were closed down and the equipment sold (Edwards, 1987, p. 76).

Interest was renewed in 1924, when cable tool drilling for liquid asphalt was begun. This asphalt was refined, not for traditional petroleum products, but for a substance called Icthyol which was a medicinal ingredient used in a skin remedy (Caldwell, 1979). The California Division of Oil and Gas wildcat map W3-1 shows eight wells drilled between 1924 and 1927 in this area, which were probably in response to this unusual play. Shortly these operations ceased, and the old asphalt pits ended their existence by becoming the town dump (Edwards, 1987, p. 76).

In 1930-31, sixteen wells were drilled along the beach, from just west of the mouth of Carpinteria Creek to within a half mile of Rincon Point, all in the intertidal zone and all undoubtedly by wildcatters following the trend of higher gravity Vaqueros (early Miocene) discoveries at Summerland oilfield the year before (see Kennett, this volume). The casings of two of these wells, the R. W. Caspers130-1A, total depth 1025 feet, and the G. A. McDonald 120-1A, total depth 1024 feet, are visible on the beach within the park boundaries during low sand conditions (Edwards, 1987, p. 76).

Figure 6. Location map for R.E. Caspers and G.A. McDonald wells.

Little evidence of Carpinteria's asphalt mining industry remains today. The refinery and mining equipment have been removed, the pits filled with trash and covered over with asphalt of a newer vintage, and the remainder eroded by the sea. Along the beach east of the mouth of Carpinteria Creek, at the first exposure of asphalt, careful examination will reveal old timbers supporting a sea wall of asphalt, behind the protection of which asphalt and bituminous sand have been mined away. Viewing this sea wall from the top of the low sea cliff, the red bricks of one of the ovens which were used to heat the miners shovels may be seen. Walking farther east at' beach level, the visitor may see blocks of coarse concrete, which were probably once equipment footings, among the rip-rap boulders which have been placed to protect the sea cliff from erosion. Trending southeastward in the intertidal zone, a long concrete trough is visible at low tide which was probably used to provide seawater to the refinery (Edwards, 1987, p. 76).

GEOLOGY

Previous Works

All of the seeps listed in the table, above are in Miocene Monterey Shale, except for seep 2-61 which is in Pleistocene Older Alluvium (Dibblee, 1986). A regional geologic report on the central Santa Ynez Mountains is found in Dibblee (1966). A historical overview of the Carpinteria Valley was made by Clark (1962). Geologic reports for the on-shore seeps include those of Arnold (1907), Yerkes and others (1969), Welday, 1977, Priestaf (1979), Jackson and Yeats (1982), Snyder (1987), Edwards (1987), , and Wilkerson (2018). Nearby off-shore seeps are described by Wikinson, 1971. Information about the Monterey Formation is found in Garrison and others (1987), Ingel, (1981, 1983), Issacs, 1981a, 1981b, 1981c, 1981d), Ogle and others, 1987, Snyder, (1987), and Wilkerson (1988a, 1988b, 2018). Mechanisms for seep creation are described by Mulqueen (2008).

Current Conditions

The seep area has been modified by urban development and construction of Carpinteria State Beach and Campground. The bedrock in this area is lower phosphatic Monterey Formation (Garrison and others, 1987) which exhibits some cherty fracture facies. The Monterey beds are vertical or steeply dipping to the south and sometimes to the north. The seeps follow a bedding plane fault as witnessed by brecciation and occasional slickensides. The overlying marine terrace deposits are named the “Punta Gorda Terrace”. It exhibits coastal dune sand, beach sands and pea gravels, marine terrace silts and ripped-up clasts of Monterey formation. There are occasional areas of yellow sulfate associated with bedding planes and fractures. Some of these are from methane and hydrogen sulfide reduction. Others are alteration products from pyrite.

Historical Geologic Descriptions

The features of the seeps in the Monterey Shale were attributed to a fault by Arnold (1907):

In the vicinity of the Carpinteria asphalt mine and to the southeast along the shore for about a mile the shale is very petroliferous, tar oozing from the joint cracks at many places. This substance not only forms black coatings over the exposures on the beach, but cements sea weed, shells, and pebbles into a firm conglomerate which forms a layer over the rocks near the water (PL III, B)[See figure 1 this paper].*Deposits of asphaltum are formed from the oil or tar which exudes from the shales and penetrates the overlying Pleistocene sands. PL III,* B [See figure 2 this paper], *shows a characteristic seepage of oil from the Monterey shale forming the floor of the Carpinteria asphalt mine. Wells drilled in the shales in this vicinity also yield small amounts of heavy oil. This occurrence of petroleum in the shale is associated with a zone of fracture and a fold, parallel to this zone, affecting the Monterey along this part of the* coast (Arnold, 1907, p. 29).

Edwards provided a cross section for the geology of the Carpinteria oil seep area:

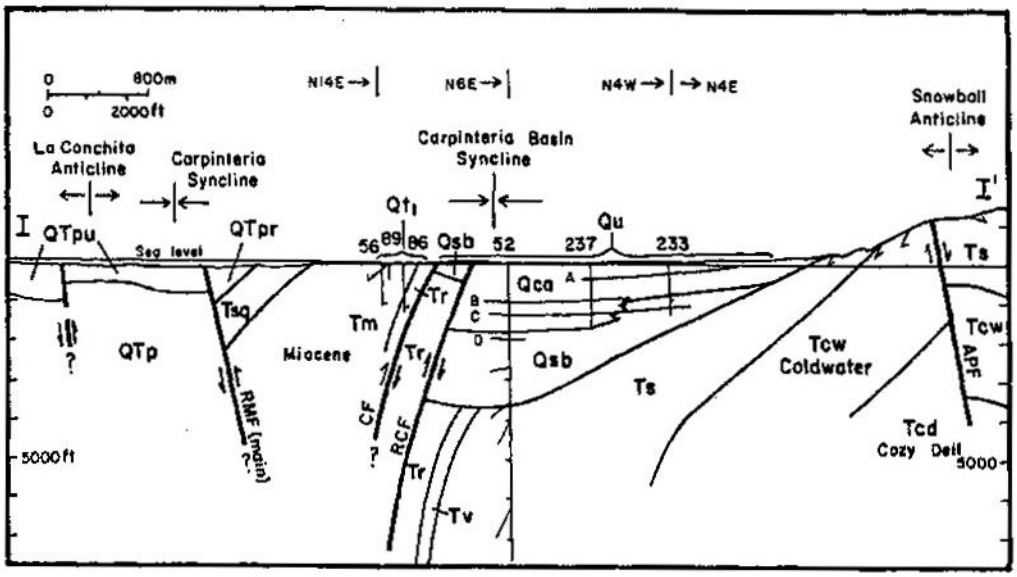

Figure 7. Figure 1. Geologic cross section through Carpinteria State Beach. RFM is Red Mountain Fault, CF is Carpinteria Fault, RCF is Rincon Creek Fault. From Jackson and Yeats, 1982 in Edwards, 1987.

The following is Edwards (1987, p. 77) description of the structure and stratigraphy at Carpinteria State Beach:

Underlying Carpinteria State Beach Park and the beach east of the park boundary is a south-dipping, essentially homoclinal sequence of middle to upper Miocene sediments of the Monterey formation. These rocks are upthrust between the north-dipping Red Mountain fault, located approximately one mile offshore to the south, and the south-dipping Carpinteria fault located less than one-quarter mile to the north (Jackson and Yeats, 1982, fig. 11). North of the Carpinteria fault, a south-dipping wedge of lower Miocene Rincon shale is found in the subsurface below a thin cover of Pleistocene marine sediments of the Santa Barbara formation. Another quarter-mile to the north, beneath Carpinteria Avenue, the Rincon is terminated by the south-dipping Rincon Creek fault which, at this location, exhibits approximately 3600 feet of vertical offset and separates the Miocene coastal exposures from the thick Pleistocene marine and non-marine sediments which fill the Carpinteria Basin. Offshore, to the south, beyond the Red Mountain fault, seafloor outcrops consist of the Pliocene Pico formation and the underlying rocks of the Monterey formation dip south into a deep syncline before being thrust and folded into the anticlines of the offshore Rincon Trend (Ogle, et.al., 1987)(Edwards, 1987, p. 77).

The Red Mountain fault and the Rincon Creek fault form the boundaries of an upthrust wedge of Miocene rocks which parallel the coastline. This wedge is complexly cut by a series of north-and south-dipping reverse faults, including the Carpinteria fault, but also including many others which are of relatively small displacement and are un-named. To the west, the faults bounding the wedge separate and a drag fold is developed in the hanging wall of the Rincon Creek fault (Jackson and Yeats, 1982), providing a trapping mechanism for the Summerland oilfield. To the east, near Rincon Point, the wedge narrows and the dips steepen, ultimately becoming overturned (Edwards, 1987, p. 77).

The area covered by this field trip segment extends from the mouth of Carpinteria Creek to the prominent headland approximately one-quarter mile east of the park boundary, which blocks further travel eastward at beach level (See Edwards, 1987 fig. 4)[Reproduced Figure 11 this report]. *In this area, the Monterey formation is fairly well exposed at the base of the sea cliff, and in the intertidal zone; however, because the strike of the exposures is essentially parallel to the coastline, only a thin stratigraphic interval is available for inspection. Some intertidal features mentioned in this report may not be apparent in summer when a thick cover of beach sand is deposited by longshore drift and not removed by storm surf. No detailed geologic mapping of this small area has been published* (Edwards, 1987, p. 77).

The most recent published mapping of this small section of beach is that of Dibblee (1986) which shows a thin band of upper Monterey shale, of Mohnian age [13.5-7.5 m.a.], *dipping 81 to 48 degrees to the south within the park*

boundary, but overturned 80 degrees to the north in the eastern part. It is the author's opinion from field observation that these north dips represent the north limb of a small scale, faulted chevron-type fold which may be traced along the base of the sea cliff throughout most of the exposure, rather than an overturn. Numerous small-scale internal Monterey folds may be seen in the intertidal zone at the eastern park boundary, and in the cliffs of the eastern headland. These internal folds are common within the Monterey, occurring at scales ranging from hand specimen to outcrop and are believed to be a response to flexural slip deformation in a sequence characterized by zones of widely varying ductility (Snyder, 1987) (Edwards, 1987, p. 77-78).

PROXIMITY TO OIL FIELDS

The Carpinteria Oil Seeps are in an area surrounded by four oil fields:

OIL FIELD	**DISTANCE FROM CARPINTARIA OIL SEEPS**
Summerland Offshore	11,000 ft
Carpinteria Offshore	12,000 ft
Rincon Creek (Abandoned)	10,000 ft`
Rincon	11,500 ft

A map showing the location of oil fields in relation to the oil seeps is provided in figure 2.

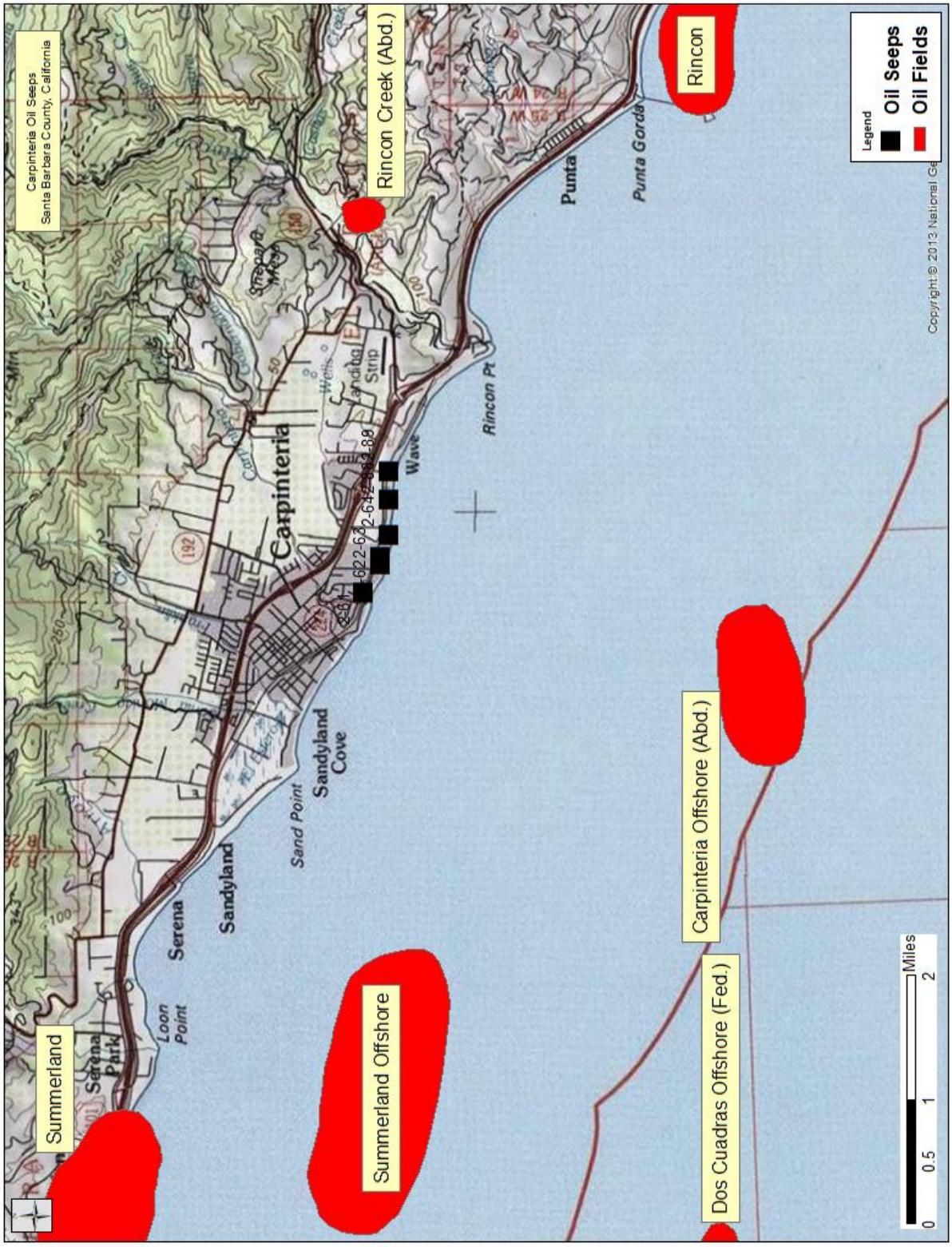

Figure 8. Oil fields near the Carpinteria Oil Seeps.

NEARBY OIL WELLS

Between Sand Point to the northwest and Rincon Point to the southeast, surrounding the Carpinteria oil seeps, there are 63 abandoned oil wells. Data for these was obtained from the California Geologic Energy Management Division (CalGEM, 2021) website. That data is abstracted in Table 2 and illustrated in Figure 77. Wells near the Carpinteria oil seeps are described in Wilkerson (2018). Few of these have spud dates, so they must be very old. Rigorous records were not kept until after 1915 (Rintool, 1985, p. 24).

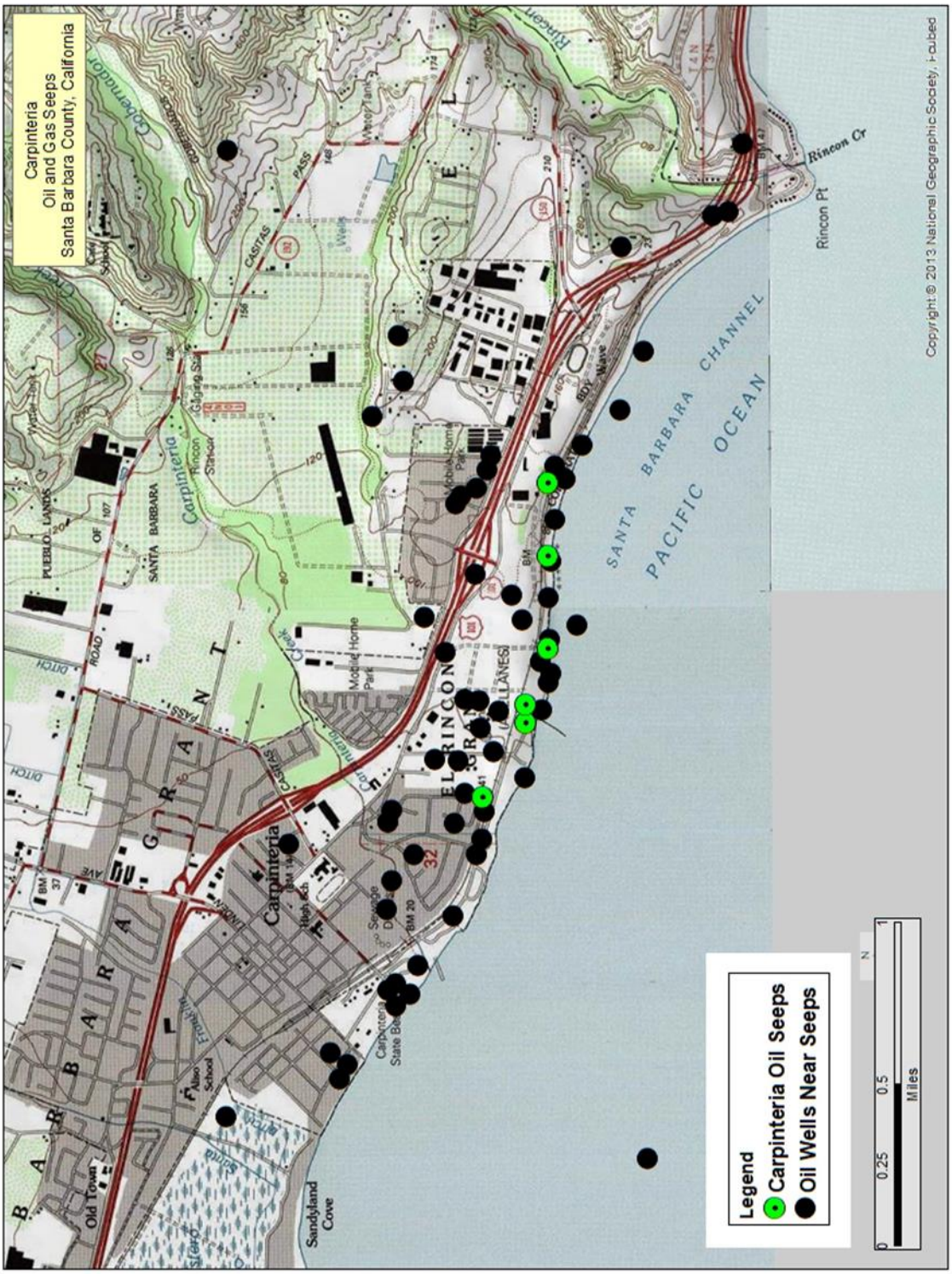

Figure 9. Oil wells and seeps near Carpinteria State Beach,

One well is particular interest because it is associated with the most active of the Carpinteria oil seeps. This is the Kittie C. Bailard Well No. 1. The following information is from CalGEM (formerly CDOGGR) records dated May 17, 2017 (Beenham, 2017).
:

Conoco Kittie C. Bailard Well No. 1

Above the beach, on the marine terrace, north of the railroad tracks near Stop W46, is the Conoco Kittie C. Bailard Well No. 1, API No. 08304290. The well is at Latitude 34.386133, Longitude -119.502432 . It is plugged and abandoned. It is in T.04N, R.25W. Section 33. The well was proposed for drilling to 4,000 feet on April 17, 1929 by the Continental Oil Company of Arizona. It was drilled to a depth of 4,535 feet. The well was sidetracked, and no oil sands were encountered. The Water Shut of test of May 15, 1929 reported that the test was 1,480 feet deep. From 1 to 500 feet there was "surface wash and shale. Heavy asphalt in fractures". From 500 to 1,480 feet there was "Brown shale and shells . Heavy asphalt in fractures with slight gas showings." The well was abandoned December 2, 1929 after a series of mishaps including twisting off of 2 strands of drill pipe, fishing, side tracking, and having pipe stuck in the hole. The lithologic log of April 26, 1929 noted the following (Beenham, 2017):

1224-1231 feet: Shells and gas
1458-1470 feet: Blue clay and gas
2357-2372 feet: Core recovery, bottom foot had fractured and slickensided clay with oil
2574-2563 feet: Core recovery, brown clay shale – fractured dip 70 deg. – oil
2618-2620 feet: Core recovery hard compact thinly striated brown shale – dip 70 deg. Oil stains.
3016-3020 feet: Brown shale – gas
3070-2079 feet: Hard light brown shale – oil and gas
3228-3245: Core recovery, brown clay shale – fractured – oil 55 deg. – oil stains
3433-3439 feet: Hard shell - gas

The well was transferred to Conoco, Inc on July 1, 1979. On December 20, 2011 the CDOGGR notified Conoco that they suspected oil seeps near the Kittie Bailard No. 1 well were due to leakage of that well. On January 6, 2012 Conoco proposed a work plan to dig an excavation 20 feet x 20 feet wide and 6 to 10 feet deep to expose the wellhead for the Kittie Bailard No. 1 Well. The wellbore diagram of September 27, 2012 is reproduced, below:

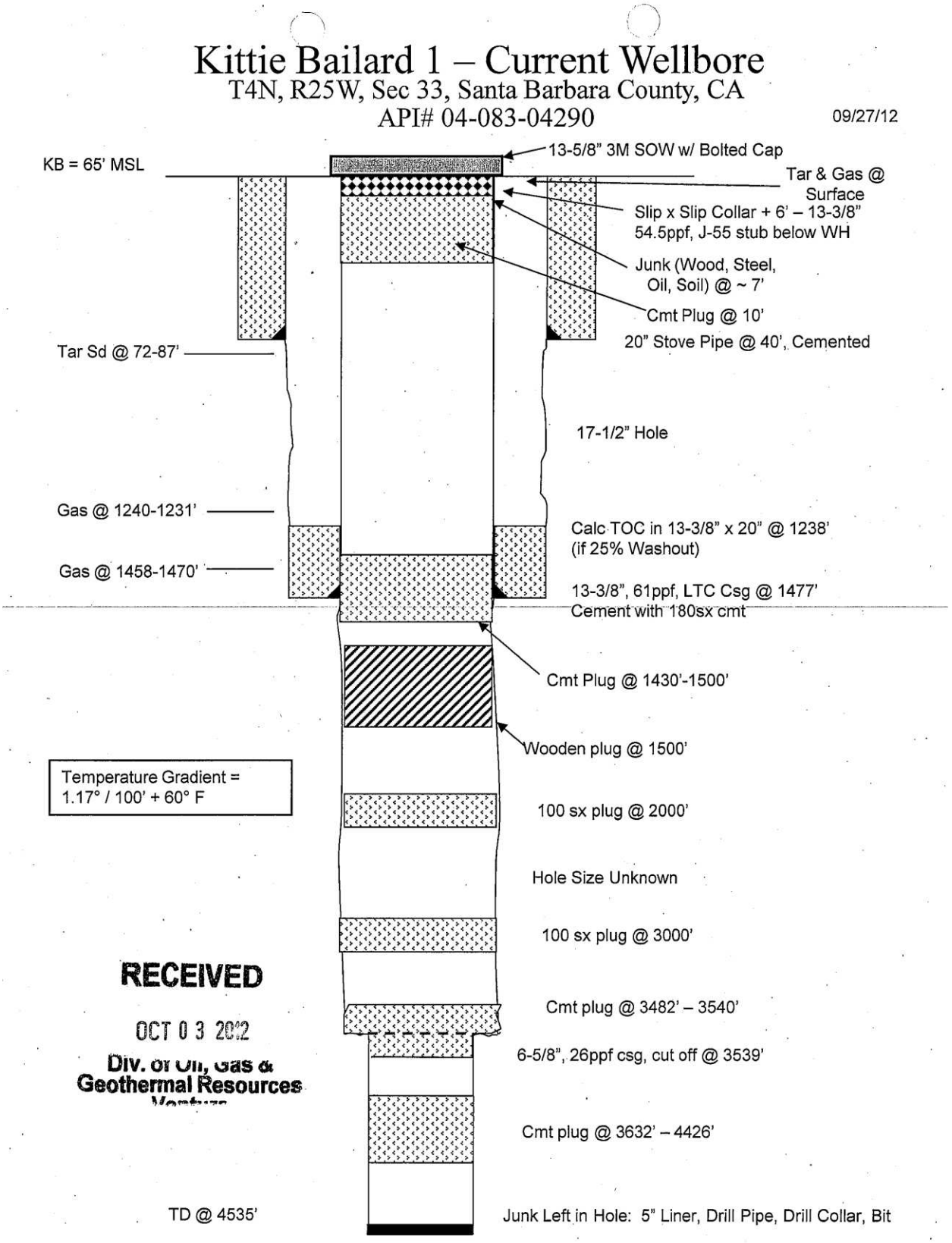
Kittie Bailard 1 – Current Wellbore
T4N, R25W, Sec 33, Santa Barbara County, CA
API# 04-083-04290
09/27/12
KB = 65' MSL
13-5/8" 3M SOW w/ Bolted Cap
Tar & Gas @ Surface
Slip x Slip Collar + 6' – 13-3/8" 54.5ppf, J-55 stub below WH
Junk (Wood, Steel, Oil, Soil) @ ~ 7'
Cmt Plug @ 10'
20" Stove Pipe @ 40', Cemented
Tar Sd @ 72-87'
17-1/2" Hole
Gas @ 1240-1231'
Calc TOC in 13-3/8" x 20" @ 1238' (if 25% Washout)
Gas @ 1458-1470'
13-3/8", 61ppf, LTC Csg @ 1477' Cement with 180sx cmt
Cmt Plug @ 1430'-1500'
Wooden plug @ 1500'
Temperature Gradient = 1.17° / 100' + 60° F
100 sx plug @ 2000'
Hole Size Unknown
100 sx plug @ 3000'
RECEIVED
OCT 0 3 2012
Div. of Oil, Gas & Geothermal Resources
Cmt plug @ 3482' – 3540'
6-5/8", 26ppf csg, cut off @ 3539'
Cmt plug @ 3632' – 4426'
TD @ 4535'
Junk Left in Hole: 5" Liner, Drill Pipe, Drill Collar, Bit

Figure 10. Diagram of Kittie Bailard No. 1 well. From Beenham (CalGEM) 2017.

Subsequent study of this refurbishment or re-abandonment effort failed to stop oil and gas seepage. It was concluded that his seepage is not related to the well, but rather to natural geologic conditions around the well (Beenhaam, 2017).

PALEONTOLOGICAL STUDIES

Many different kinds of fossils have been found in the Carpinteria oil seeps (Hoffman, 1927; Chaney and Mason, 1934,).

Edwards (1987, p. 76) relates that

In the late twenties, the asphalt deposits were once again mined, by the Santa Barbara Museum of Natural History and the Carnegie Institute, this time for their fossil content. The asphalts have yielded a rich plant and bird assemblage and a mammalian fauna including mastadon, ground sloth and bison (Edwards, 1987, p. 76)

Figure 11. Tar with fossils, Carpinteria oil seeps. Photo by Bob Gray.

Figure 12. Bird bones in tar matrix. Photo by Bob Gray.

WALKING TOUR FOR THE CARPINTERIA OIL SEEPS

In 1987 Edwin Edwards wrote a field guide and description of the Carpinteria oil seeps and associated geologic and historic-archaeologic features. Edward's field guide was expanded by Wilkerson (2018). Below is an anthology of some of the most interesting stops on these walking tours of the Carpinteria Oil Seeps. I have annotated stops and features for this walking tour on a series of seven aerial photographs. An index map for these photographs is on page 69. The photographs are on pages 70 to 76. A georectified map for the entire walking tour can be downloaded from my website at http://www.greggwilkerson.com/carpinteria-oil-seeps.html.

This map is also available through Academia.edu at
https://www.academia.edu/37644723/Carpinteria_Oil_Seeps_Santa_Barbara_County_California_Map

The maps are designed for use with the Avenza.pdf cell phone app. You can get that for free from
https://www.avenza.com/download/

This app puts a blue dot on my map at your current location. Use this to find the stops and features described in this field guide.

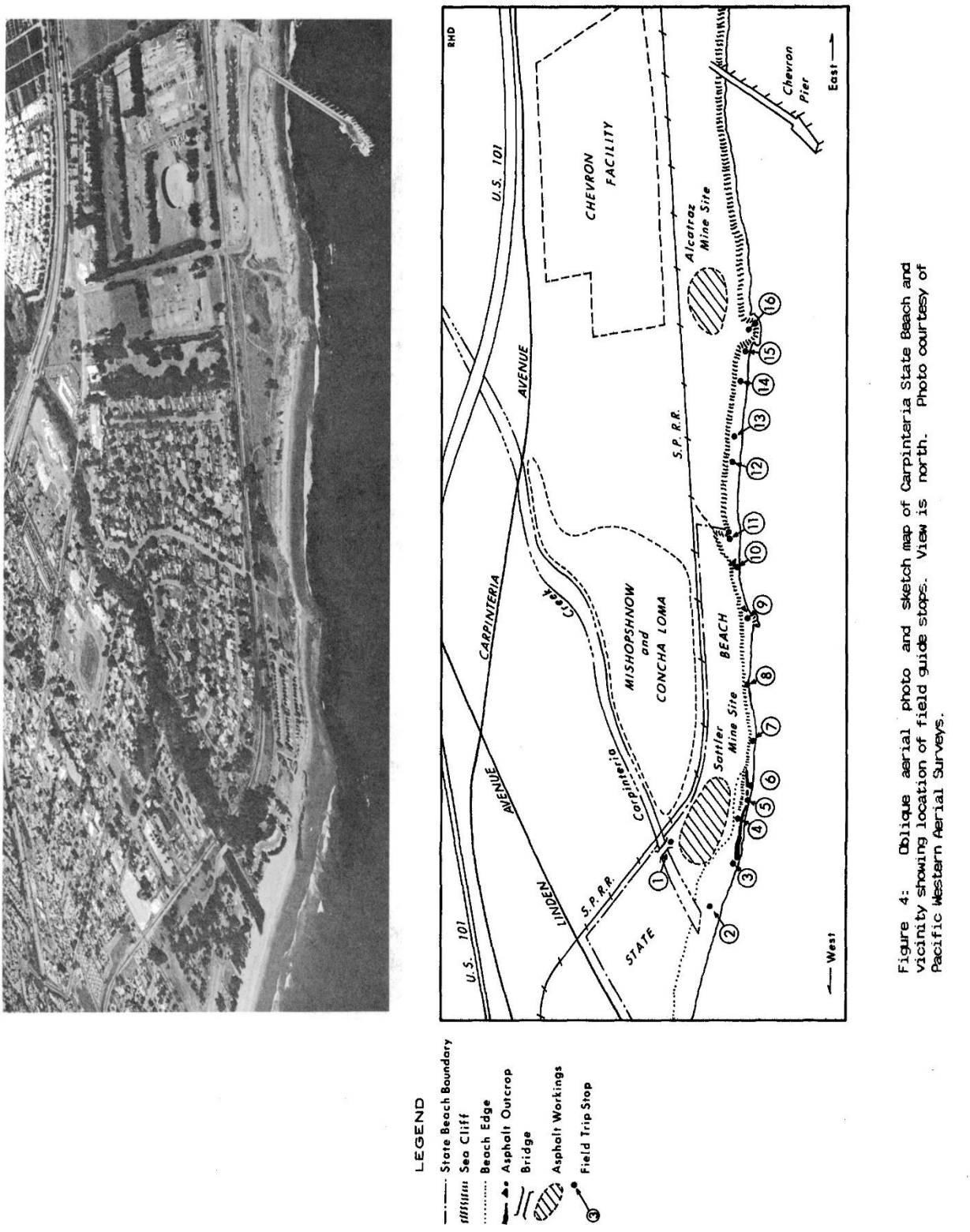

Figure 4: Oblique aerial photo and sketch map of Carpinteria State Beach and vicinity showing location of field guide stops. View is north. Photo courtesy of Pacific Western Aerial Surveys.

Figure 13. Oblique aerial photo and sketch map of Carpinteria oil seeps. From Edwards, 1987, Figure 4. This figure shows Edward's numbered locations.

AERIAL PHOTO NO. 1

Stop 01: Bridge over Carpinteria Creek

Go to the east side of the bridge, then walk down to the beach through low sand dunes. The area to the east of this bride is the original location of the Sattler asphalt workings. This asphalt quarry had 200 employees and was active from the late 1800's to the early. The Sattler refinery was to the west of the restroom facility (Edwards, 1978, p. 81, Stop 1).

The seeps begin southwest of the bay mouth bar at the seaward end of Carpinteria Creek near the lifeguard lookout for the eastern part of Carpinteria State Campground. From Stop 01 walk 150 yards southwest to Stop 02.

Stop 02: Tidal Delta

Note the variation in size of the sediments and their composition. See how they change from the fluvial to the littoral sedimentary facies as we walk toward the ocean. Red and green clasts are from the Oligocene Sespe Formation. Tan and brown clasts ae Eocene Coldwater Sandstone, Cozy Dell Shale and Matilija Sandstone. Banded white clasts are Miocene Monterey Formation (Edwards, 1987, Stop 2; Dibblee, 1987). Walk 107 paces (535 feet) to an outcrop of asphalt. Walk 150 yards southeast to Stop 03.

AERIAL PHOTO NO. 2

Stop 03: First Asphalt

At low tide, where Carpinteria Creek enters the ocean, seeps are exposed oozing out of the Monterey Formation (Edwards, 1987, Stop 3). Walk 40 yards southeast to Stop 4

Stop 04: Well Casing

The well casing for the R.W. Caspers Well No. 130-1A drilled in 1930 to a depth of 1,025 feet can be seen at low tide. This is one of sixteen wells drilled along the beach from Carpinteria Creek to Rincon point following the discovery of relatively high-quality Vaqueros (lower Miocene) oil at Summerland field in 1929 (Edwards, 1987, p. 81, Stop 5.). The bedrock here is lower Monterey formation. The well casing is not leaking any hydrocarbon. Walk 35 yards southeast to Stop 05A.

Stop 05A: First Mining Features

This is the western end of mining operations along the shoreline. The asphalt at these seeps was a renewable mining operation with a wooden sea wall seaward of the seep zone. The seeps followed a bedding-plane fault. The sea wall kept the water out during periods of high tide. The narrow zone was excavated as a trench and asphalt periodically removed therefrom. A railway system was used to convey hand-dug asphalt to the refining site (Edwards. 1987, Stop 4). Walk 20 yards southeast to Stop 05B.

Figure 14. Stop 05A. West end of Tar Deposit 01. Remnants of a retaining wall have been engulfed by the tar.

Stop 05B: Western oven

The west end of the railway ended at a furnace complex. These furnaces were not for distilling the asphalt. They were for heating shovels that cut through the asphalt for its excavation. This area is near the lifeguard tower (Edwards, 1987, Stop E7). Remnants of the seawall can be seen here as well as block of concrete and bricks, many of which have been absorbed into the asphalt following decommissioning of the complex. The furnaces are at the base of an east-trending asphalt "finger" that extends out onto the beach, just past the lifeguard station (Edwards. 1987, p. 81, Stop 7). Walk 20 yards northeast to Stop 06.

Stop

Figure 15. Stop 05B, western oven. These were used to heat shovels for hand-excavation of asphalt landward of the retaining wall that kept the seaward ocean at bay.

Stop 06. Central oven

Foundations of an oven complex for heating shovels was once at this spot.

Figure 16. Stop 06. Central oven with five foundations.

Figure 17. Stop 07. Cement foundation.

Stop 07. Cement Foundations.

These foundations are landward of the seeps and may have been a hoist foundation for lifting tar on to train cars. Walk 20 yards southeast to Stop 08A.

Stop 08A: Wooden Planks

These wood planks are remnants of a retaining seawall that kept the ocean waters out of the asphalt mine pits. Go 20 yards north to Stop 08B.

Stop 08B: Lifeguard Tower.

This land mark is the first appearance of Punta Gorda terrace deposits. This terrace surface has been dated at 45,000 years further east at Rincon Mountain. ote asphalt-impregnated sands rather than pure asphalt. Seeps of heavy oil are becoming more common along cha base of the terrace. Outcrops offshore are Mont-erey fm. As you continue east, watch for asphalt-impregnated pebble to cobble conglomerate at base of terrace and for asphalt-saturated cross-bedding in overlying sands (Edwards, 1987, p. 81, Stop 7). Walk 15 yards south to Stop 09.

Figure 18. Stop 08A Wood Planks in tar (TA-1)

Stop 09: Eastern Oven

This is the easternmost of the oven complexes.

Figure 19. Stop 09. Eastern Oven now covered with ice plant..

From Stop 09 walk 10 yards southeast to Stop 10.

Figure 20. Stop 10, fossil hash in oil sand above terrace deposits. (See Hoffman, 1927)

Stop 10: Fossil Hash

This fossil bed is within Punta Gorda marine terrace materials. From Stop 10 go 53 yards southeast to Stop 11.

Figure 21. Stop 11, east end of Tar area TA-01

Stop 11: East end Tar Area 01

At the eastern end of Tar Area 01 there is a concrete trough trending diagonally offshore from this point was the bed for an iron pipe which may have supplied sea water to the asphalt refinery for use in de-sanding the asphalt or, alternatively, may have carried effluent away (Edwards, 1984, p. 81, Stop 6). From Stop 11 go 63 yards east to Stop 12.

AERIAL PHOTO NO. 3

Figure 22. Stop 11. East end of Tar Area 01.

Stop 12: Tar Graffiti

Tar is used in crude artistry and messaging. From Stop 12 go 15 yards south to Stop 13.

Figure 23. Stop 12. Tar graffiti.

Figure 24. Stop 12. Tar graffiti.

Stop 13: Tar zone

East-trending zone of asphalt in surf zone. From Stop 13 walk 65 yards southeast to Stop 14.

Stop 14: Well Casing

Edwards (1987) describes this as his Stop 5 for the Caspers 130-1A Well, but CalGEM records place this well further west at my Stop 04. This casing at Stop 14 is also not in described in CalGEM records. You can only see it at low tide. From Stop 14 walk 42 yards northeast to Stop 15.

Stop 15: Monterey Formation, tar and shells

The ridges of Monterey outcrop seaward from here are erosion resistant dolomitic siliceous shale beds of the organic shale member. A few steps back the way you came, these intertidal outcrops have been heavily bored by pholad clams, the shells of which are still in evidence. The shell cavities have been filled with asphalt. Note mounds of asphalt intermixed with these intertidal outcrops. Shore-ward, along the base of the cliff, is a good expo-sure of Monterey intraformational breccia. Note two generations of fracturing; one calcite-filled, the other filled with asphalt. Breccias such as these are most common in brittle rocks in the hinges of tight folds and may be in part due to transient overpressuring (Snyder, 1987). The altitude of this outcrop approximates the average dip within this fault block and measures 77 degrees, north 81 west (Edwards, 1987, p. 81-82, Stop 8). From Stop 15 walk 12 yards southeast to Stop 16A.

Stop 16A: Tar Cliff and circular excavations.

This erosional feature is an abrupt 5-foot high cliff of asphalt. From Stop 16A walk 10 yards east to Stop 16B.

Figure 25. Stop 16A. Man-made arcuate excavations into oil sand, near railroad track exposure. These are the same size and shape. This suggests that they were made with a giant auger machine.

STOP 16B: Railroad Tracks

Archaeologists have exposed a buried railroad track that used to service the Alcatraz open pit asphalt mining operation. From Stop 16B walk 28 yards east to Stop 17.

Figure 26. Stop 16B. Excavated narrow gauge railroad track. This railroad connected the Sattler and Alcatraz mines and tar pits along the waterfront.

Stop 17: Conglomerate in Tar

Eastward of the arcuate excavations are exposures of Punta Gorda terrace materials. Note the large gravel clasts are from recent beach evolution and oil seepage. They are not part of the Punta Gorda terrace deposits. From Stop 17 walk 31 yards ast to Stop 18.

Figure 27. Stop 17 Conglomerate with tar at base of Punta Gorda terrace deposits.

Stop 18: Cross Bedding in oil sand.

Sand dunes in the Punta Gorda marine terrace have been filled with oil (now tar). The seep is active along the base of the sandstone which rests upon fluvial gravels. From Stop 18 walk 16yards east to Stop 19.

Figure 28. Stop 18: Cross bedding in oil sand with a shell layer at the base.

Stop 19: Gunite erosion control.

To control erosion, Gunite (shotcrete) cement has been applied to the oil sand. The lower part is painted black to resemble the oil sand, and the upper part is buff to resemble the terrace deposits. From Stop 19 walk 15 yards east to Stop 20.

Figure 29. Stop 19. Painted Gunite (shotcrete) cement covering oil sand for erosion control. The left side is natural oil sand.

Stop 20: Sand

These sand beds are in the Casitas or Santa Barbara Formations. From Stop 20 walk 30 yards east to Stop 21.

Stops 21 and 22: Fractured Monterey Formation

East of the Gunite erosion control feature, we begin to see exposures of the lower phosphatic section of the Monterey Formation (Garrison and others, 1987) below an erosional unconformity with the Punta Gorda terrace deposits. There are two generations of fracturing. Late fractures are filled with calcite and early ones with asphalt. From Stop 21 walk 25 yards east to Stop 22.

Figure 30. Stop 21. Monterey Formation underlying tar zonw in Punta Gorda terrace materials.

From Stop 22 walk 44 yards to Stop 23.

AERIAL PHOTO NO. 4

Stops 23 and 24: Stairway and G.A. MacDonald 120-1A Well

On the beach, about half-way between the foot of the stairs and the prominent outcrop to the right, is the casing of the G. A. McDonald 120-lA well, drilled in 1931 to a depth of 1024 feet. This casing may not be visible under high sand conditions. The author was unable to find any geologic records of or this or the Casper well in the files of the Cal GEM (formerly California Division of Oil & Gas). This well, too, appears to be properly abandoned, as no seepage has been observed (Edwards, 1987, page 82, Stop 9). To see the casing, walk 32 yards south from Stop 23.

This is a good location to observe the lithology of the organic shale member of the Monterey formation which is best exposed in the intertidal outcrops just to the east. Note the alternation of dark laminated shales up to several feet thick with hard, erosion-resistant beds of dolomitic siliceous shale ranging from several inches to one foot thick. The light colored shale laminations are made up of blebs, Lenses and laminae of phosphate (carbonate fluorapatite) while the dark material is organic-rich marlstone·. Both the marlstone and the phosphate show microscopic evidence of bacterial structures suggesting that bacteria may have been important in apatite formation by releasing phosphate from the organic matter under low oxygen sea-bottom conditions (Garrison, Kastner and Kolodny, 1987). The distinctive appear-ance of the phosphate laminae aids in field recognition of the organic shale member, and it is re-peated at smaller scale under the hand lens, frequently permitting recognition of this unit in drill cuttings. These intertidal outcrops also show significant intraformational folding which occuring in relatively incompetent units of the Monterey. Here the numerous sharp folds appear to plunge steeply eastward (Edwards, 1987, page 82, Stop 9).

Further evidence of the complexity of internal Monterey structure may be seen by closely examining the large outcrop at the low tide line. Here, individual blocks of phosphatic marlstone, dolomitic siliceous shale and dolomite are seen to be complexly intermixed, to the point of forming a breccia, Note that there is little evidence of soft sediment deformation; the laminae of marl-stone blocks terminating sharply against other lithologies without contact distortion, suggesting that the individual blocks were at least partially lithified before being disturbed, Also, there is no evidence of significant, through-going fracturing as would be expected if this were a tectonic breccia. Probably the best interpretation is that this is a sea-floor slump deposit composed of partially lithified blocks of organic shale member lithologies with the interstices between blocks being filled n by continuing deposition of phosphatic marl (Edwards, 1987, page 82, Stop 9).

Figure 31. Stop 23. Wooden staircase with tar flow. Out in the surf zone, about half-way between the foot of the stairs and the prominent outcrop to the right, is the casing of the G. A. McDonald 120-1A well, drilled in 1931 to a depth of 1024 feet. This casing may not be visible under high sand conditions.

Examination of the sea cliff at this locality reveals a lobate seep of asphalt spilling out onto the beach just east of the foot of the stairs. This seep appears to issue from the base of the Punta Gorda-terrace- deposits. Both left and right of the stairs, Monterey lithologies are exposed at the base of the cliff which are not typical of the organic shale member. These rocks consist of light tan, low density, diatomaceous, largely non-calcareous, somewhat punky shales lacking dolomitic interbeds. Such lithologies are more typical of the upper units of the Monterey, including the upper calcareous and upper siliceous members. If this is correct, a fairly significant fault is indicated between the rocks exposed on the beach and those in the sea cliff. Perhaps a fortuitous future storm will improve the exposure enough to make a definitive interpretation; otherwise some paleontologic work would seem to be indicated (Edwards, 1987, page 82, Stop 9).

Finally, observe the terrace deposits in the· cliff to the left of the stairs. Note the white sand layer separating asphalt-impregnated sands at the base and top of the bluff, This may reflect episodic activity of these seeps over the last 45,000 years. Continue eastward along the base of the cliff watching for tar-filled Monterey fractures and small seeps (Edwards, 1987, p 82. Stop 9).

Figure 32. Stop 24. Phosphatic member of Monterey Formation.

From Stop 23 (staircase) walk 45 yards east to stop 25A.

Stops 25A and 25: Salt Grass and Oil Sand

These stops illustrate the resilience of salt grass: it can grow in oil seeps! Not the cross bedding in the oil sand. These are Punta Gorda terrace materials.

Figure 33. Stop 25A. Salt Grass in tar.

Figure 34. Stop 25B. Cross Bedding in oil sand in Punta Gorda Terrace deposits above fractured Monterey Formation. Note salt grass in the oil sand

From Stop 25B walk 7 yards east to Stop 26.

Stop 26: Oil Seep "Falls"

The oil here flows down over Monterey Formation rocks like waterfalls. From Stop 26 walk 13 yards southeast to Stop 27.

Figure 35. Stop 26, oil seep "falls" over Monterey Formation.

Stop 27: Active Seep Area

One of the most active seeps is at Stop 27: This is a lobate seep at abandoned oil well or pipe. A three inch pipe is discharging oil and water. There is no CalGEM (CDOGGR) record of a well at this location. It may be simply a pipe driven into the rock formation. This seep is 200 feet southwest of the CalGEM location for the Searoad Asphaltum and Refining Well No. 4.

Figure 36. Stop 27, lobate oil flow and seep at possible oil well site.

From Stop 27 walk 30 yards east, then circle back 10 yards north and 20 yards west to the top of the marine terrace to arrive at Stop 28

Figure 37. Stop 27 at very active lobate seep deposit near Searoad Asphaltm No. 4 Well.

From the beach, you can walk up to the top of the terrace and view the oil seep coming out of a pipe.

This is one of the most active seeps along this beach, but as will be discussed shortly, it may not be entirely natural, Note the iron, brick, concrete and cobbles embedded in the surface of the semi-solid asphalt and observe the numerous seeps of heavy oil which are spilling onto the beach sand, slowly extending this outcrop toward the sea. Use caution in exploring here because small pools of fresh, wet oil are frequently found lurking under a quarter-inch of apparently dry beach sand in this area, In the cliffs here, and into the mouth of the small gully just ahead, are further exposures of Monterey lithologies which appear to be younger than the organic shale member (Edwards, 1987, p. 82, Stop 10).

Continue along the cliff into the mouth of the small gully and climb left onto the. bluff at the first opportunity. Atop the bluff, turn left and walk out to the point. You are now directly above the lobate seep of stop 10. At the time of writing this was the site of a "tar-volcano", the result of gas bubbling up through liquid asphalt. On warm days when the seep was most active, these bubbles would burst and throw droplets of oil into the air where they would drift with the wind to coat the wooden barricade and sign which marked the site [The sign is no longer here]. *This section is written in the past tense because the California Division of Oil & Gas believes this may be an old oil well (potentially the W.W. Gregg well, 1924, depth 360 feet) rather than a natural seep. If so, they will be obliged to attempt to abandon it properly and these features may not be visible at field trip time, About 20 feet to the north (toward the mountains) is a concrete circle which the D.O.G. believes may be an old tank footing* (Edwards, 1987, p. 82-83, Stop 10).

Figure 38. Stop 29, pipe from oil well?

Stop 28: Pipe or Oil Well Casing?

Looking east from this vantage point, observe the Punt Gorda terrace deposits atop the headland at the east end of the beach and note that they dip approximately four degrees inland rather than seaward as would be expected. This is evidence of continued recent uplift of coastal rocks relative to those farther north under the terrace. Also note the asphalt impregnated sand outcrop just across the gully to the east. Return east down the trail and proceed to that point (Edwards, 1987, p. 83, Stop 10). Walk back 30 yards to the east and 10 yards south to Stop 29.

Stops 29 and 30: Salt Grass and spring

On the way to oil sands on the east side of the gully you pass an area of Salt Grass, and a freshwater spring area with willows. From Stop 29 (salt grass), walk 10 yards east to Stop 30. From Stop 30 walk 13 yeards south to Stop 31.

Stop 31: Graffiti in Oil Sand

The west-facing cliff has graffiti carved into it. Below the graffiti are oil sands with various constituents The upper part is Punta Gorda terrace, the lower part is Monterey Formation. This is a good exposure of the unconformity between the Monterey formation and ohe overlying Punta Gorda terrace. The unconformity here is at an elevation of about 5 feet whereas, looking east down the beach, the same unconformity can be seen to reach an elevation of about 30 feet. This tilting of the terrace surface has occurred since its formation, about 45,000 years ago, This same surface is at an elevation of 655 feet on Rincon Mountain, about 4 miles east. 1n this outcrop, notice the presence of a basal pebble conglomerate and well ex-posed cross-bedding in the asphalt-impregnated sands, Pebble lithologies consist primarily of two types; t ese are well-rounded greenish and tan sandstones, probably of Sespe (Oligocene) and Coldwater (Eocene) origin, and sub-rounded fragments of various Monterey lithologies. These units are well exposed in the mountains to the east and north, Also included are occasional well-rounded clasts of exotic lithologies such as quartzite which are probably re-worked from the highly conglomeratic Sespe. At the base of the cliff the Monterey lithology appears to be typical' of the organic ·shale member. Although not a very clear exposure, these rocks appear to be tightly folded. Observe asphalt fracture filling and small active seeps (Edwards, 1987, p. 83, Stop 11).

Enroute to the next stop watch for sulfur staining on outcrops and notice the prevailing south dip of the Monterey. Also observe that asphalt-impregnation is restricted to the basal part of the terrace deposits and that it thins to a thickness of only two feet (Edwards, 1987, p. 83, Stop 11).

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Figure 39. Stop 31: Asphalt impregnated terrace deposits. There are clasts of Sespe and Coldwater Sandstone Eocene rocks as well as clasts of Monterey Formation.

From Stop 31, go 13 yards east to Stop 32.

Stop 32: Hydrothermal sulfate alteration in Monterey Formation

Walking eastward yields exposures of sulfate in the Monterey Formation from hydrothermal alteration. The sulfate is seen along bedding plains with tar. From Stop 32, go 38 yards east to Stop 33.

Stop 33: Fossil Oil Seep

The asphalt here is old and has hardened into a fossil seep. From Stop 33, go 17 yards east to Stop 34.

Stop 34: Conglomerate with tar

Here is an accumulation of conglomerate and asphalt. From Stop 24, go 38 yards east to Stop 35.

Stop 35: Sulfate at contact with asphalt

Here is another area of hydrothermal sulfate alteration at a contact with seep materials. From Stop 35, go 3 yards east to Stop 36.

Figure 40. Stop 35 Sulfate in Monterey Formation. The sulfate can be an agent of concretion development (Loyd and others, 2012)

AREAL PHOTO NO. 5

Stop 36: Sickly tree at fresh water spring

At the top of the bluff is a tree in Punta Gorda marine terrace materials. It is nourished by a fresh water spring as indicated by the change in vegetation. Below the terrace materials are folded and faulted oil-soaked Monterey Formation units.

Notice the numerous small springs of. water issuing from the Monterey at the base of the cliff, The shales here are both foraminiferal and diatomaceous under the hand lens and do not have the visual aspect of the organic shale member (Edwards, 1987, p. 83, Stop 12). From Stop 36, go 39 yards doutheast to Stop 37.

Figure 41. Stop 36: Folded Monterey Formation beneath Punta Gorda terrace deposits. Note spring along the crest of the cliff where there is a tree.

Stop 37: Tree in arroyo.

As at stop 36, the tree is taking advantage of a fresh water spring in this gully.

Notice that these rocks, which again do not look like the organic shale member, dip north, Are they overturned or are they in the down-faulted north limb of a sharp anticline tren-ding parallel 'to the coastline? While close in-spection shows some of these shales to be laminated, it is a very even, fine-grained type rather than the blebby, grainy phosphate lamination of the organic shale member. Continue eastward watching for the re-appear-ance of typical organic shale member lithology (Edwards, 1987, p. 83, Stop 13). From Stop 37, go 20 yards southeast to Stop 38.

Stop 38: Oil Sands reappear.

At this point, we see more evidence of fossil seeps from oil-soaked sands in the Punta Gorda terrace materials. From Stop 38, go 38 yards southeast to Stop 39.

Stop 39: Folded Organic Shales

This outcrop has lower Monterey Formation phosphatic beds.

Here, typical organic shale member is folded into a sharp, faulted anticline with a smooth syncline adjoining to the south. Close looking shows additional small, active seeps in this area (Edwards, 1987, p. 83, Stop 14). From Stop 39, go 21 yards southeast to Stop 40.

Stop 40: Dolomitic Concretion

Secondary groundwater movements have created dolomitic concretions in the Monterey Formation. From Stop 40, go 52 yards southeast to Stop 41.

AERIAL PHOTO NO. 6

Figure 42. Stop 40: Dolostone concretions in Monterey Formation.

Stop 41: End of beach oil seeps

The east end of the oil seeps is Stop 41. A little farther, around the point is a offshore drilling platform service pier. The cliffs here expose step-shearing in the laminated shales and for numerous asphalt-filled fractures and heavy oil seeps. The rocks offshore of the point are dolomites and dolomitic siliceous shales of the organic shale member. For a description of secondary carbonates in the Monterey formation, see Pisciotto (1983).

This large, west-facing outcrop shows very complex folding and faulting within the organic shale member. Examine the outcrop for step-shearing in the laminated shales and for numerous asphalt-filled fractures and heavy oil seeps. The rocks offshore of the point are dolomites and dolomitic siliceous shales of the organic shale member (Edwards, 1987, p. 83, Stop 15).

The next objective is the top of this bluff. This can be achieved in three ways. At low tide and in calm sea conditions, the nimble of foot can scramble quickly around the point into the next cove where, however, they will be faced with a twenty-foot climb up a pile of very large -angular rip-rap boulders, In the alternative, retrace your steps until you find a negotiable section of bluff to climb, This field trip takes the conservative approach and returns along the beach to stop 10 from which a good trail is available along the top of the bluff (Edwards, 1987, p. 83, Stop 15).

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Figure 43. Vista of Chevron oil platform servicing pier. Photo taken on the bluff above Stop 41 at Stop 42.

Figure 44. Stop 41: End of Beach

Return to Stop 30 near the mouth of the large gully. Then go eastward up onto the bluff and thence 280 yards to a large flat meadow. This is the site of the abandoned and reclaimed Alcatraz Mine. At one time it was the town dump.

Stop 42: Overlook

This point on the edge of the sea cliff provides a vista of the Channel Islands to the south and the Alcatraz mine to the north. Be cautious near the cliff edge.

Looking east additional exposures of the Monterey formation are seen in the cliffs and coves between here and the Chevron pier. In the first cove, the rocks are typical organic shale member and dip generally south; however, entering the next cove dips steepen to vertical and ultimately overturn to steep north dip and the transitional contact with the underlying lower calcareous member is ex-posed. The lower calcareous shale member is com-posed of thick-bedded dolomites and dolomitic siliceous shales with only thin interbeds of phosphatic marlstone, If there is a significant, down-to-the-north fault paralleling the outcrops we have just visited, it must trend a little to the north under the terrace deposits at this point. If so, it might help explain the presence of another major asphalt deposit which once existed here (Edwards, 1987, p. 84-85, Stop 16)..

The hummocky, grassy swale just north of this point was the location of the Alcatraz (spanish for pelican) asphalt mine at the turn of the century. Very little evidence of it is left today, except for the subtle topographic disturbance. Along the near edge of the depression old timber fragments and metal parts may be found embedded in asphalt and

around other edges small, active heavy oil seeps may be located in the grass. When the mine closed, the pit was used as the town dump (Edwards, 1987, p. 84-85, Stop 16).

On a clear day this is a good place to observe the string of production platforms which marks the crest of the Rincon offshore trend, the marine extension of the same structural feature which forms the trap for the Rincon, San Miguelito and Ventura Avenue fields. Looking back west, the two platforms which produce the Summerland off-shore field should be visible (Edwards, 1987, p. 85, Stop 16). From Stop 42, walk 90 yards to the north to Stop 43A.

Figure 45. Memorial to walker who fell to their death because they got too close to the cliff edge.

Stop 43: Site of the Alcatraz Asphalt Mine

At one time, the meadow you in which you are standing was an open pit mining operation with drag lines and railroads to extract the asphalt. After the mine closed, it was made into a city dump. It was then leveled and revegetated as part of the creation of Carpinteria State Park. From Stop 43A, walk 25 yards southwest to Stop 43B.

Figure 46. Stop 43: Alcatraz Mine. View to the north from Stop 42.

Figure 47. Alcatraz tar mine with drag line, 1902. Photo from Bob Gray.

Figure 48. Alcatraz tar mine, 1902. Photo from Bob Gray.

Figure 49. Alcatraz tar mine. Digging with hot shovels. Photo from Bob Gray.

Figure 50. Fossil collecting at Alcatraz tar mine, 1927. Photo from Bob Gray. See Hoffman, 1927.

Figure 51. Carpinteria tar mine.1927. Photo from Bob Gray.

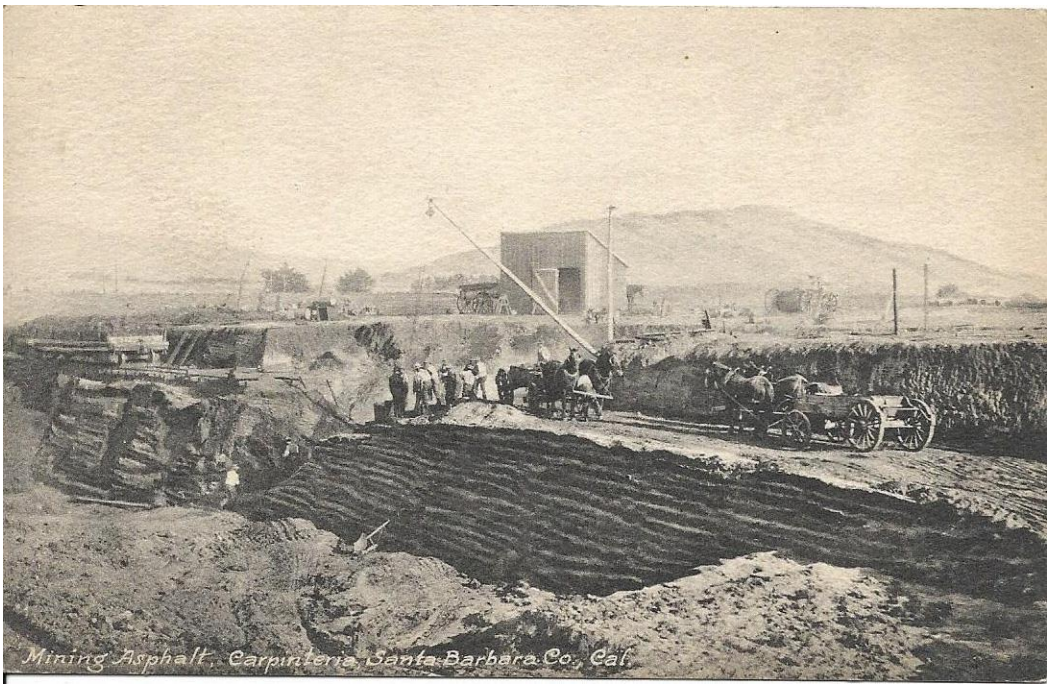

Figure 52. Undated post card. From Bob Powers.

Stop 44B: Alcatraz Mine Oil Seeps

The old mine continues to seep oil on hot days.

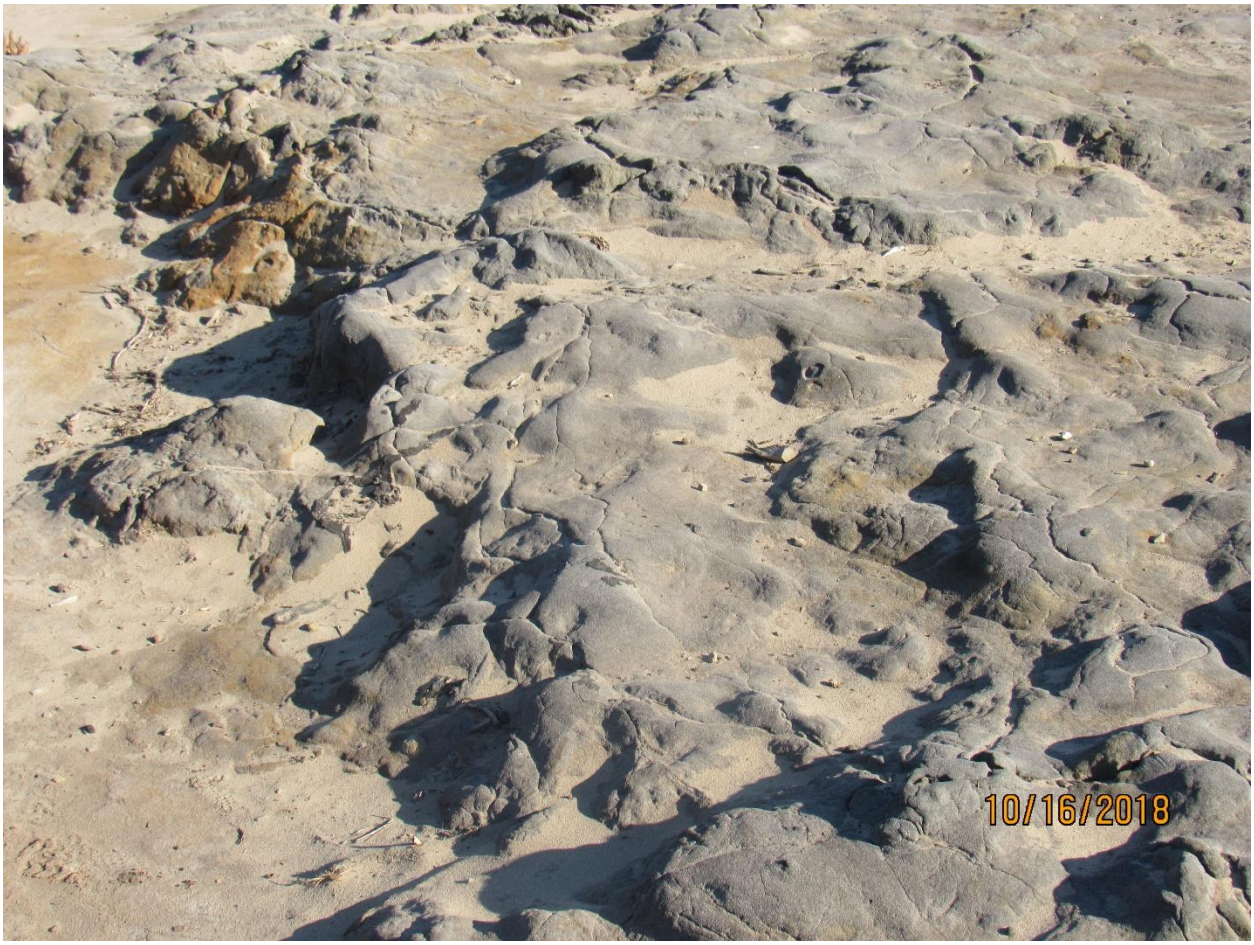

Figure 53. Stop 44B: Alcatraz Mine Seeps.

From the Alcatraz Mine meadow, walk south to a hiking trail, then north to the trail that is along the south side of the railroad (133 yards). Then walk east 121 yards to the road that leads to the Chevron oil service pier. Take the paved road across the railroad tracks. On the north side of the tracks there is a frontage road. Walk east 440 yards to a dirt bike path. Then follow the path 107 yards east past a row of trees on your left (north). Now go north 28 yards to Stop 44.

AERIAL PHOTO NO 7.

Stop 44: Kitty Bailard No. 1 oil well.

The site of this well is marked by a concrete slab and hatch cover. It was abandoned in the 1930's. The well started to leak in 2015. Excavations showed that the abandoned well was not leaking, but natural seepage around it was discharging from the well area.

Figure 54. Stop 44: Kitty Bailard No. 1 Re-abandonment site.

Return to the hiking trail. Retrace your steps southward to the railroad tracks. Cross the railroad tracks and continue southwest 75 yards on the trail to Stop 45.

Stop 45: Paved Road

A paved road goes eastward down to the beach at this point. Go west 75 yards down the paved road to Stop 46.

Stop 46: No oil sands

The Monterey Formation and Punta Gorda marine terrace materials in this road cut have no oil seeps. The rock is unstained with tar. Why is there so much oil seeping nearby, but none here? Oil migration has several factors. Oil pools are limited in extent due primarily to the trapping structures which allow the oil to accumulate. These rocks do not have the porosity or permeability, or a trapping structure to permit significant oil pool formation.

Figure 55. Stop 46: No oil staining or seeps here.

Return to Stop 45. Then turn left and go 75 yards west back toward the Carpinteria State Park campgrounds to Stop 47..

Stop 47: Fractured Monterey Shale

Here the Monterey shale is extensively fractured, Veinlets of secondary gypsum have filled several of them. But there is no oil seepage. From Stop 47, walk 80 yards west to a trail junction, then another 40 yards to Stop 48.

Stop 48: Seal Sanctuary

Here is a vista of the Chanel Islands and information about the marine sanctuary for seals and other sea life.

Figure 56. Stop 48: Seal Sanctuary.

Return to the main trail, turn left, walk 415 yards to the Chevron Pier access Road. Then continue another 650 yards to the east end of Carpinteria State Park Campground. From there it is another 600 yards back to Stop No. 1 at the bridge crossing Carpinteria Creek.

SUMMARY

The Carpinteria oil seeps are millions of years in the making. We have journeyed through that history from the diatoms that flourished in a Miocene sea, through their death, burial and conversion to oil and gas. Those accumulations of hydrocarbon then migrated several thousand feet to Carpinteria beach where humans used the tar for their survival. We have seen remnants of industrial scale development of the seeps and have gotten tar on our shoes. In so doing we became part of the story. One day the seeps will be gone, driven by a never-ending rock cycle. But others will appear in other places. I hope this tour imprinted a memory in your heart and mind that you will enjoy sharing.

ABOUT THE AUTHOR

Gregg Wilkerson experienced tar seeps as an infant when he visited his grandparents beach cabin on Rincon Beach. In those days the tar was more abundant and a kerosene jar was kept on hand for frequent cleanup before entering the cabin. He was a student at U.C. Santa Barbara from 1974 to 1978. His first geology job was as a mud logger for

Thomas Williams of Petrolog Oil Well Logging Company. In that job he visited several seep areas including those in Sulfur Mountain. After completing his doctorate at University of Texas El Paso, he became a mineral appraiser and worked for the Department of the Interior evaluating leases for competitive bidding. He is a 45 year member of the Coast Geological Society. His motto: “Every rock has a story to tell”.

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MAPS

Figure 57. Topographic map of the Carpinteria Oil Seeps. Seep locations from Hodgson, 1980.

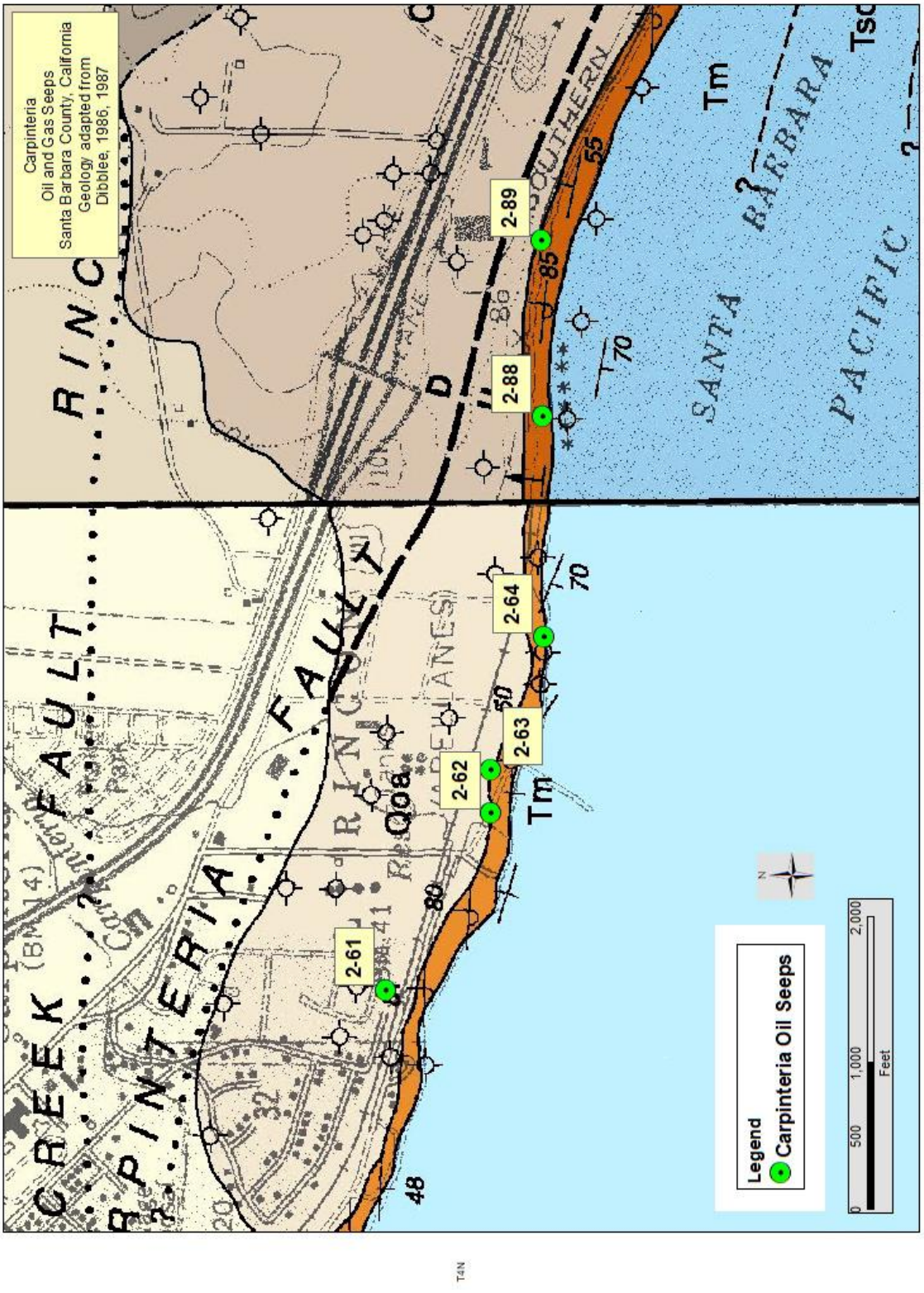

Figure 58. Geologic map of the Carpinteria Oil Seeps. Adapted from Dibblee, 1987 and Dibblee, 1986. Seep locations from Hodgson, 1980.

Figure 59. Aerial photograph of the Carpinteria Oil Seeps. Photo adapted from ESIR, 2018. Seep locations from Hodgson, 1980.

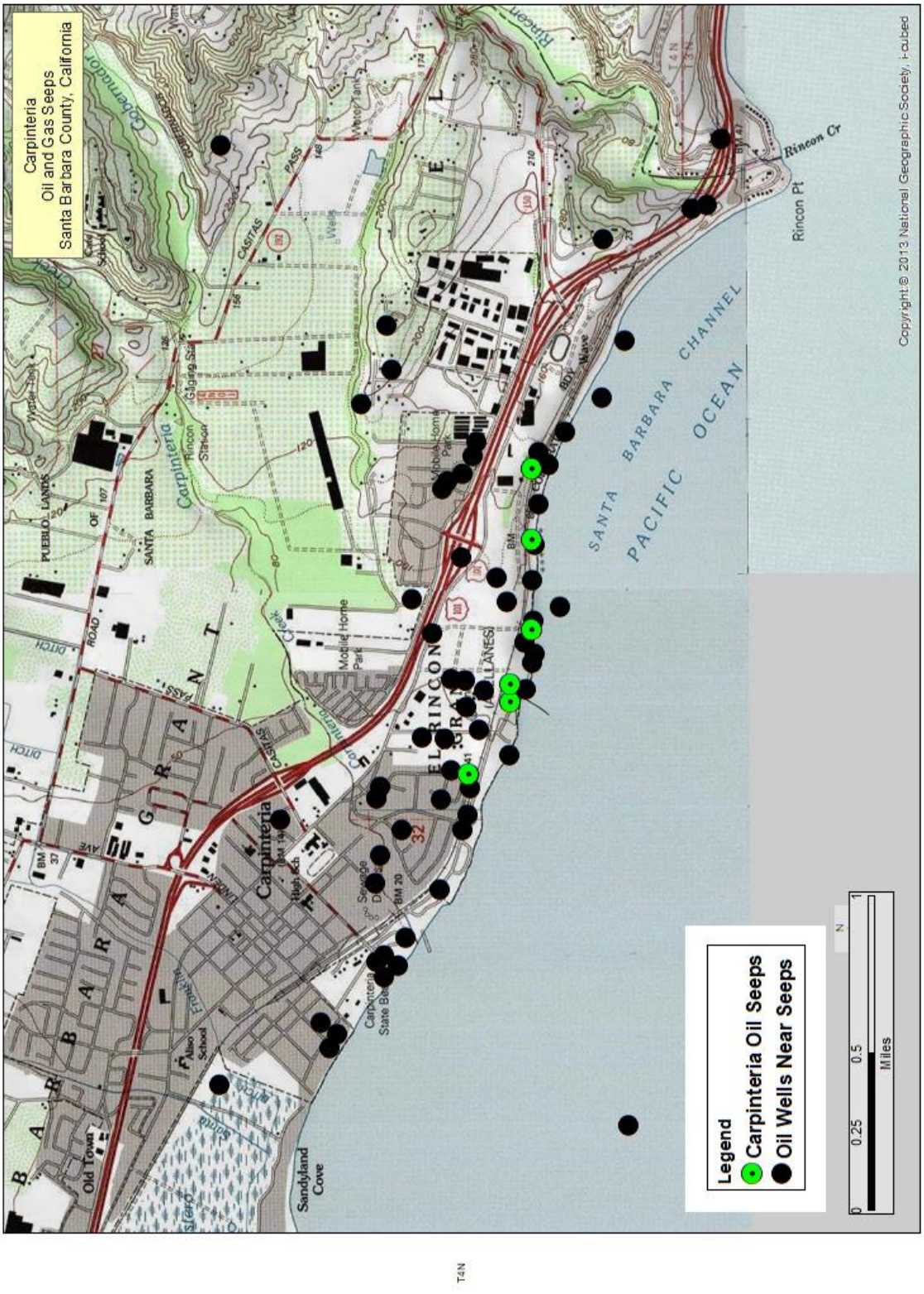

Figure 60. Abandoned oil wells near the Carpinteria Oil Seeps. Seep locations from Hodgson, 1980. Well data from CDOOGR. For list of wells see Table 2.

AERIAL PHOTOGRAPHS FOR THE WALKING TOUR

Aerial Photographs 01 to 07

PHOTO INDEX MAP

Figure 61. Aerial photo index map

Figure 62. Aerial Photo 01.

Figure 63. Aerial Photo 02.

Figure 64.Aerial Photo 03.

Figure 65. Aerial Photo 04.

Figure 66. Aerial Photo 05.

Figure 67. Aerial Photo 06.

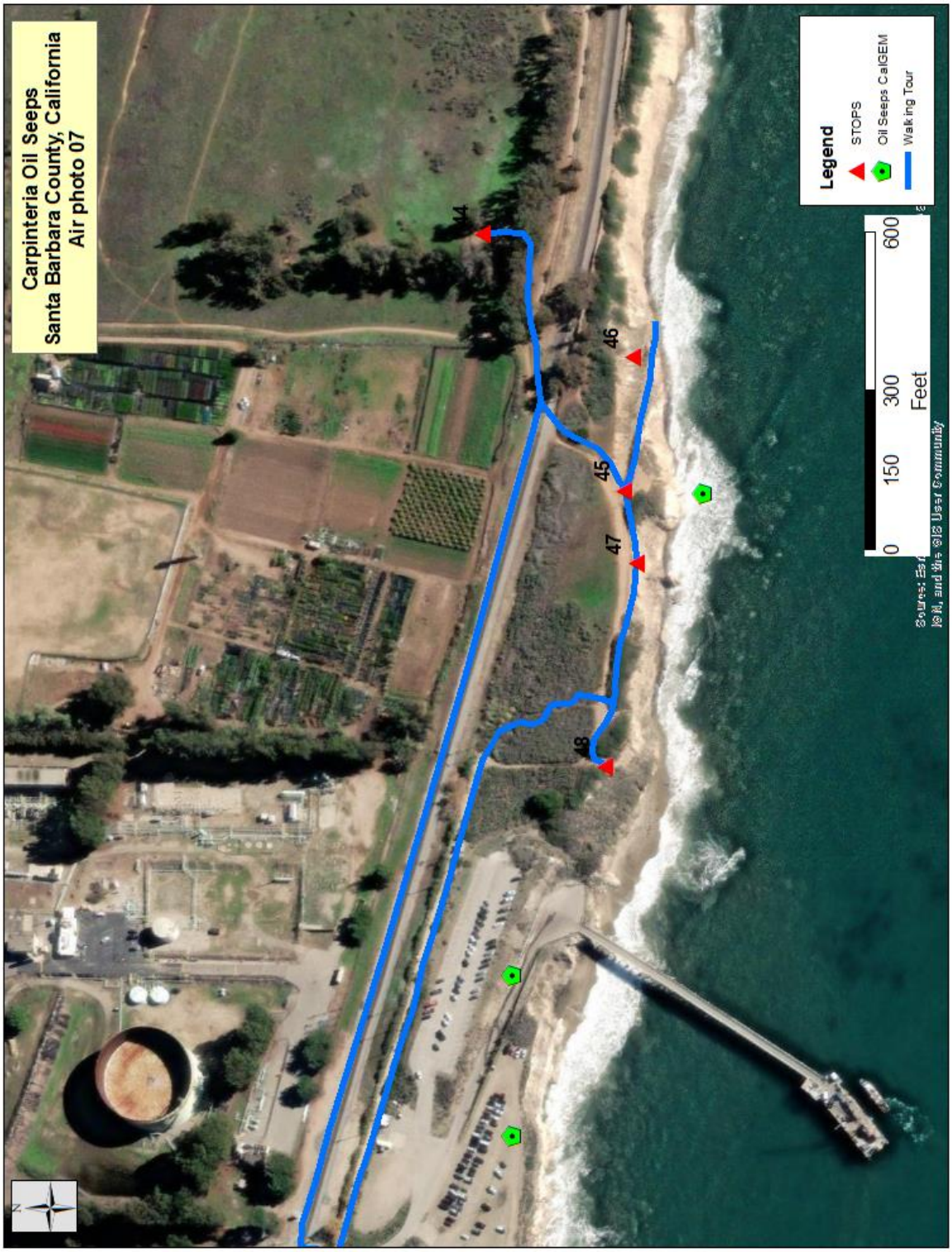

Figure 68. Aerial Photo 07.

MAPS WITH WALKING TOUR STOP ANNOTATIONS

TOPOGRAPHIC

GEOLOGIC

AERIAL PHOTO

TOPOGRAPHIC

Carpinteria Oil Seeps
Santa Barbara County, California

Columbian Oil Asphalt & Refinery Well No. 2
Carpinteria Oil Co. Carpinteria 1
McDonald Drilling Co. 165-1
Justin S. Snow Well No. 190-1
Lester L. Pedersen Core Hole 2
Lester L. Pedersen Core Hole 1
Nixon & Bosig Well No. 1
Nixon & Bosig Well No. 2
Nixon & Bosig Well No. 1
Lester L. Pedersen Core Hole 3
Chevron U.S.A. Inc. Carpinteria Community Lease #3 1
James F. Nugent Oil Co. Well No. 1
C. M. S. Oil and Drilling Co. 1
R. W. Caspers Well No. 130-1A
Searoad Asphaltum & Refining 1
James F. Nugent Oil Co. Well No. 2
Searoad Asphaltum & Refining Well No. 2
Thornbury Drilling Co. Carpinteria Community 1
Geo. A. McDonald Well No. 120-1-A
Walter W. Gregg Well No. 1
Searoad Asphaltum & Refining Well No. 4
D. S. Fletcher Catlin-Fletcher 1
Thornbury Drilling Co. Community 3
P. C. Higgins P.C. Higgins 1
Thornbury Drilling Co. Carpinteria Community 1
Columbian Oil Asphalt & Refinery Well No. 1
Conoco Inc. Kittie C. Bailard 1
Lucien M. Higgnis Well No. 121-1
Callie M. Higgins Well No. 122-1
Conoco Inc. Franklin 1
Thornbury Drilling Co. Carpinteria Community 2
Theresa Franklin State Permit 123 1
Kittie C. Bailard State Permit 124 1-A
Conoco Inc. State Permit 124 1

E01, W01
E02, W01
E04-W08W10
E03-W06
W05
E04-W13
E04-W12
E02-W11
E06-W15
W16
W19
E05-W14
W21
W22
E07-W17
W18
W24
W26
W32
E09-W23
W25
W29
W30
W35
E10-W33
E11-W34
E13-W37
E09-W24
E14-W39
W38
W43
W40
W44
E15-W41
E16-W42
W48
W47
W46
W45
W44

Legend
STOPS
Oil Wells Near Seeps

Feet
0 500 1,000 2,000

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

GEOLOGIC MAP

Carpinteria Oil Seeps
Santa Barbara County, California
Geology adapted from Dibblee 1986

CARPINTERIA FAULT

Columbian Oil Asphalt & Refinery Well No. 2
Carpinteria Oil Co. Carpinteria 1
Lester L. Pedersen Core Hole 2
Lester L. Pedersen Core Hole 1
Nixon & Bosig Well No. 2
Nixon & Bosig Well No. 1
McDonald Drilling Co. 165-1
Justice-Snow Well No. 190-1
E01, W01
Lester L. Pedersen Core Hole 3
Chevron U.S.A. Inc. Carpinteria Community Lease #3 1
E02, W01
James F. Nugent Oil Co. Well No. 1
C. M. S. Oil and Drilling Co. 1
R. W. Caspers Well No. 130-1A
Searoad Asphaltum & Refining 1
James F. Nugent Oil Co. Well No. 2
E04-W08W10
E03-W06
W05
E04-W13
E04-W12
E02-W11
Searoad Asphaltum & Refining Well No. 2
Thornbury Drilling Co. Carpinteria Community 1
Geo. A. McDonald Well No. 120-1-A
Walter W. Gregg Well No. 1
E06-W15
W18
W19
E05-W14
Searoad Asphaltum & Refining Well No. 4
D. S. Fletcher Catlin-Fletcher 1
Thornbury Drilling Co. Community 3
E07-W17W18
W21
W22
W24W26
W32
P. C. Higgins P.C. Higgins 1
W30
W35
E09-W23
W25
E10-W33
E12-W37
E09-W24
E11-W34
Thornbury Drilling Co. Carpinteria Community 1
W38
W43
E14-W39
W40
W44
Columbian Oil Asphalt & Refinery Well No. 1
E15-W41
E16-W42
Conoco Inc. Kittie C. Bailard 1
W44
Lucien M. Higgnis Well No. 121-1
W48
W47
W46
Callie M. Higgins Well No. 121-1
Conoco Inc. Franklin 1
W45
Thornbury Drilling Co. Carpinteria Community
Theresa Franklin State Permit 124 1
Kittie C. Bailard State Permit 124 1-A
Conoco Inc. State Permit 124 1

Qs
Qoa
Tm
BM 20
32
87
48
80
50
70

Legend
- STOPS
- Oil Wells Near Seeps

0 500 1,000 2,000 Feet

AERIAL PHOTO

Carpinteria Oil Seeps
Santa Barbara County, California
Aerial Photo Index Map

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Legend

Walking Tour

Aerial Photos

0 500 1,000 2,000 Feet

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

TABLES

01. Carpinteria Oil Seeps
02. Wells Near Oil Seeps
03. Walking Tour way points

TABLE 01:Carpinteria Oil Seeps

TABLE 1: CalGEM OIL SEEPS CARPINTERIA
(Hodgson, 1980) STATE BEACH

CA Seep Number	LONGITUDE WEST	LATITUDE NORTH	Township	Range	Section	Base Meridian
2-61	-119.5120	34.3880	4N	25W	33	SB
2-62	-119.5080	34.3860	4N	25W	33	SB
2-63	-119.5070	34.3860	4N	25W	33	SB
2-64	-119.5040	34.3850	4N	25W	33	SB
2-88	-119.4990	34.3850	4N	25W	33	SB
2-89	-119.4950	34.3850	4N	25W	34	SB

TABLE 02: Wells Near Oil Seeps

APINumber	Operator	Section	Township	Range	B&M	Latitude	Longitude	Lease	Well Number	Definition
08304645	Nixon & Bosig	33	04N	25W	SB	34.39200700300	-119.51267493300	Well No.	1	Active Oil & Gas
08304653	Nixon & Bosig	33	04N	25W	SB	34.39215800800	-119.51329697300	Well No.	1	Plugged Dry Hole
08304654	Nixon & Bosig	33	04N	25W	SB	34.39215900800	-119.51329597300	Well No.	2	Plugged Dry Hole
08304655	Northern Consolidated Oil Co.	33	04N	25W	SB	34.38820793200	-119.49994810800	Well No.	1	Plugged Oil & Gas
08304644	P. C. Higgins	33	04N	25W	SB	34.38745707000	-119.50957153000	P.C. Higgins	1	Plugged Oil & Gas
21106002	Phillips Oil Company	2	03N	25W	SB	34.37612093500	-119.47676384500	Signal State C.H.	1	Plugged Dry Hole
28304325	R. W. Caspers	32	04N	25W	SB	34.38928214400	-119.51845523000	Well No.	130-1A	Plugged Oil & Gas
08304308	Santa Barbara Oil and Gas Co.	29	04N	25W	SB	34.39947907400	-119.52926408700	S.B.	1	Plugged Dry Hole
08304650	Searoad Asphaltum & Refining	33	04N	25W	SB	34.38920907500	-119.51342892400		1	Plugged Dry Hole
08304329	Searoad Asphaltum & Refining	33	04N	25W	SB	34.38874606300	-119.51178381600	Well No.	2	Plugged Dry Hole
08304330	Searoad Asphaltum & Refining	33	04N	25W	SB	34.38785609700	-119.51281486100	Well No.	4	Plugged Dry Hole
08304304	Tesoro Petroleum Corporation	26	04N	25W	SB	34.39920884000	-119.47694832500	Gobernador	1	Plugged Dry Hole
28304479	Theresa Franklin	33	04N	25W	SB	34.38483106200	-119.50534435200	State Permit 123	1	Plugged Dry Hole
28304296	Thomas N. Fish	29	04N	25W	SB	34.39440415500	-119.52721086100	State Permit 163	1	Plugged Dry Hole
08304312	Thornbury Drilling Co.	34	04N	25W	SB	34.39140794200	-119.48946972100	Canfield	1	Plugged Dry Hole
08304313	Thornbury Drilling Co.	33	04N	25W	SB	34.38720103600	-119.50734251800	Carpinteria Community	1	Plugged Oil & Gas
28304313	Thornbury Drilling Co.	33	04N	25W	SB	34.38870999400	-119.50675151100	Carpinteria Community	1	Plugged Dry Hole
28304314	Thornbury Drilling Co.	33	04N	25W	SB	34.38498206500	-119.50584338500	Carpinteria Community	2	Plugged Dry Hole
08304315	Thornbury Drilling Co.	33	04N	25W	SB	34.38806300900	-119.50680250200	Community	3	Plugged Dry Hole
08304643	Unknown Operator	3	03N	25W	SB	34.37679538100	-119.48043507500	Unknown		Plugged Oil & Gas
08304300	W. C. Hamilton	34	04N	25W	SB	34.38884795200	-119.49571794000	Tyler-Hamilton	1	Plugged Dry Hole
8304298	Walter W. Gregg	33	04N	25W	SB	34.38799011400	-119.51428295200	Well No.	1	Plugged Dry Hole
08303804	Western Oil Royalties, Ltd.	29	04N	25W	SB	34.39482412600	-119.52578978300	Bryce	1	Plugged Dry Hole
08304316	Western Oil Royalties, Ltd.	32	04N	25W	SB	34.39403115200	-119.52641780600	Well No.	1	Plugged Dry Hole

APINumber	Operator	Section	Township	Range	B&M	Latitude	Longitude	Lease	Well Number	Definition
08304845	Artic Oil Co.	34	04N	25W	SB	34.38459506600	-119.49408179200		1	Plugged Dry Hole
28304285	Benjamin F. Bailard	33	04N	25W	SB	34.38462304000	-119.49697891500	State Permit 127	1	Plugged Oil & Gas
28304286	Benjamin F. Bailard	34	04N	25W	SB	34.38337810400	-119.49301072400	State Permit 129	1	Plugged Oil & Gas
08304647	C. M. S. Oil and Drilling Co.	33	04N	25W	SB	34.38957293800	-119.50418737200		1	Plugged Oil & Gas
28304302	Callie M. Higgins	33	04N	25W	SB	34.38528507900	-119.50733148100	Well No.	122-1	Plugged Dry Hole
08304324	Carpinteria Oil & Gas Co.	34	04N	25W	SB	34.38161224300	-119.48228023900	Well No.	1	Plugged Dry Hole
08304177	Carpinteria Oil Co.	32	04N	25W	SB	34.39188513700	-119.52205149800	Carpinteria	1	Plugged Dry Hole
28304291	Casitas Oil Co.	34	04N	25W	SB	34.38063921600	-119.48792945900	Well No.	202-1	Plugged Oil & Gas
28304292	Casitas Oil Co.	34	04N	25W	SB	34.38170316100	-119.49110261300	Well No.	202-2	Plugged Oil & Gas
08304293	Century Oil Co.	34	04N	25W	SB	34.38767199100	-119.49432485900	Core Hole Hall	1	Plugged Dry Hole
08304309	Chevron U.S.A. Inc.	33	04N	25W	SB	34.39052989000	-119.50226627400	Carpinteria Community Lease #3	1	Plugged Dry Hole
08304310	Chevron U.S.A. Inc.	27	04N	25W	SB	34.39276489400	-119.49136082700	Core Hole	1	Plugged Dry Hole
08304311	Chevron U.S.A. Inc.	34	04N	25W	SB	34.38747000300	-119.49353082200	Core Hole	2	Plugged Dry Hole
08300769	Chevron U.S.A. Inc.	34	04N	25W	SB	34.39161795600	-119.48698061900	Core Hole	3	Plugged Dry Hole
28304441	Chevron U.S.A. Inc.	33	04N	25W	SB	34.38482901600	-119.49923301400	Well No.	126-1	Plugged Dry Hole
28301047	Chevron U.S.A. Inc.	32	04N	25W	SB	34.38063351300	-119.53157184900	Texaco-Monterey Core Hole	8-D-55	Plugged Dry Hole
08304573	Columbian Oil Asphalt & Refinery	33	04N	25W	SB	34.38656396400	-119.50109412800	Well No.	1	Plugged Dry Hole
08304574	Columbian Oil Asphalt & Refinery	32	04N	25W	SB	34.39222013500	-119.52243952800	Well No.	2	Plugged Dry Hole
08304290	Conoco Inc.	33	04N	25W	SB	34.38613255400	-119.50243170000	Kittie C. Bailard	1	Plugged Dry Hole
08304294	Conoco Inc.	32	04N	25W	SB	34.38530504200	-119.50469732200	Franklin	1	Plugged Dry Hole
28304289	Conoco Inc.	33	04N	25W	SB	34.38367005200	-119.50274217300	State Permit 124	1	Plugged Dry Hole
08304297	D. S. Fletcher	33	04N	25W	SB	34.38802903000	-119.50826258900	Catlin-Fletcher	1	Plugged Dry Hole
08304847	Dr. R. W. Hill	3	03N	25W	SB	34.37746636200	-119.48063209500		1	Plugged Dry Hole
28304306	Geo. A. McDonald	32	04N	25W	SB	34.38819612100	-119.51509000500	Well No.	120-1-A	Plugged Dry Hole
08304299	Guiberson-Cudahy	29	04N	25W	SB	34.39661792600	-119.51453513500	Shepard	1	Plugged Dry Hole
28304295	Henry Berrie Fish	32	04N	25W	SB	34.39190015400	-119.52327557300	Fish 164	1	Plugged Dry Hole
08304303	Imperial Gypsum & Oil Corp.	34	04N	25W	SB	34.38811197300	-119.49532091000	Bailard	1	Plugged Dry Hole
08304327	James F. Nugent Oil Co.	33	04N	25W	SB	34.39009000800	-119.50998173300	Well No.	1	Plugged Dry Hole
08304328	James F. Nugent Oil Co.	33	04N	25W	SB	34.38901803200	-119.51001171400	Well No.	2	Plugged Dry Hole
28304331	Justin S. Snow	32	04N	25W	SB	34.39090314500	-119.52110142200	Well No.	190-1	Plugged Dry Hole
28304287	Kittie C. Bailard	33	04N	25W	SB	34.38488403500	-119.50349624200	State Permit 124	1-A	Plugged Oil & Gas
28304288	Kyrtle Bailard	33	04N	25W	SB	34.38493600300	-119.50126010800	State Permit 125	1-A	Plugged Oil & Gas
08304537	Lester L. Pedersen	32	04N	25W	SB	34.39202105700	-119.51653816700	Core Hole	1	Plugged Dry Hole
08304538	Lester L. Pedersen	32	04N	25W	SB	34.39227507200	-119.51806026400	Core Hole	2	Plugged Dry Hole
08304539	Lester L. Pedersen	32	04N	25W	SB	34.39101805900	-119.51509806000	Core Hole	3	Plugged Dry Hole
08304305	Linc-Con Oil Operating Co.	34	04N	25W	SB	34.38908794300	-119.49612396200	Linc-Con	1	Plugged Dry Hole
28304301	Lucien M. Higgnis	33	04N	25W	SB	34.38603311200	-119.51096671400	Well No.	121-1	Plugged Dry Hole
28304326	Mary B. Hall	34	04N	25W	SB	34.38415807000	-119.49479881400		1	Plugged Dry Hole
28304814	McDonald Drilling Co.	32	04N	25W	SB	34.39123616000	-119.52263452100		165-1	Plugged Dry Hole

TABLE 03: Walking Tour way points

TABLE 3 STOPS

STOP	NOTES	LONGITUDE	LATITUDE
01	East end Carpinteria Creek Bridge	-119.51869538400	34.39101488850
02	Beach east of Carpinteria Creek	-119.51992481900	34.39030057750
03	First asphalt	-119.51876993900	34.38947569570
04	Well Casing	-119.51845523000	34.38928214400
05A	West end of TA-01, conglomerate in tar	-119.51830708700	34.38902628600
05B	Western Oven	-119.51814445400	34.38890448950
06	Central oven with 5 brick foundations	-119.51805246200	34.38895170190
07	Cement foundation	-119.51805046200	34.38890703530
08A	Wood planks in Tar	-119.51789752700	34.38879283710
08B	Guard Station	-119.51776455500	34.38891024510
09	Eastern oven	-119.51775151800	34.38879670190
10	Fossil hash oil sand	-119.51766218400	34.38879997970
11	East end of TA-01	-119.51743668800	34.38848142800
12	Tar graffiti	-119.51682507300	34.38834736860
13	East trending finger of tar	-119.51683239300	34.38821041150
14	Intertidal blocks of tar	-119.51638485100	34.38779947970
15	West end of TA-04	-119.51605040700	34.38800581300
16A	tar cliff	-119.51592368500	34.38795420190
16B	Railroad track	-119.51582101800	34.38794253520
17	Conglomerate in tar	-119.51556085100	34.38787897970
18	Active seep with shells and cross beds in	-119.51525718500	34.38784686850
19	Painted cement made to look like tar sand	-119.51510450400	34.38780346100
20	Sand below tar in Casitas or Santa Barbara	-119.51497079600	34.38775064630
21	Monterey fm under tar	-119.51468129600	34.38765492410
22	Monterey fm under tar	-119.51443157400	34.38759692410
23	Wood staircase with cement foundation	-119.51401362900	34.38748431300
24	Monterey in intertidal zone	-119.51404429200	34.38720590570
25A	Salt grass in oil sand	-119.51359029600	34.38750081290
25B	Crossbeds in oil sand	-119.51350279600	34.38750886850
26	Oil seep "falls"	-119.51342724100	34.38749931290
27	Active lobate seep area	-119.51330218500	34.38745986850
28	Oil well pipe seep	-119.51326218500	34.38751514620
29	Salt grass	-119.51303590700	34.38756992400
30	Fresh water spring with vegitation	-119.51294213000	34.38759631290
31	Carvings in oil snd	-119.51290018500	34.38748875730
32	Sulfate on bedding planes	-119.51279863000	34.38745109070
33	Fossil oil seep	-119.51245535200	34.38733664620
34	Conglomerate with tar	-119.51231402100	34.38726239850
35	Sulfate at contact	-119.51209213000	34.38720864620
36	Sickly Tree, springs	-119.51180140800	34.38712120170
37	Tree in arroyo	-119.51148468500	34.38694442400
38	Oil sand reappear	-119.51083987000	34.38670418330
39	Organic shale	-119.51070901900	34.38658097950
40	Dolostone concretion	-119.51054268600	34.38648242400
41	End of beach	-119.51024090800	34.38618525730
42	High Point of Bluffs	-119.51002618600	34.38609147960

TABLE 3 STOPS

STOP	NOTES	LONGITUDE	LATITUDE
43A	Alcatraz Mine (Site)	-119.50962263000	34.38662042390
43B	Alcatraz Mine Seep	-119.50977200400	34.38645455320
44	Kitty Balard No. 1 re-abandonment project	-119.50237429800	34.38612920130
45	Paved Road	-119.50397718700	34.38540375710
46	No oil sands	-119.50314251700	34.38535277520
47	Oil sands in fractured shale	-119.50443396500	34.38534331270
48	Seal Sancturay	-119.50569713100	34.38551264600